NP-Arguments in NPs

An Analysis of German and Spanish Noun Phrases
in Head-Driven Phrase Structure Grammar

Dissertation
zur Erlangung des akademischen Grades

Doktor der Philosophie (Dr. phil.)

eingereicht an der Philosophischen Fakultät II
der Humboldt-Universität zu Berlin

verteidigt am 06. April 2017

von
M.A. Antonio Machicao y Priemer

Prof. Dr. Dr. Sabine Kunst
Präsidentin
der Humboldt-Universität zu Berlin

Prof. Dr. Ulrike Vedder
Dekanin
der Philosophischen Fakultät II

Gutachter:

1. Prof. Dr. Stefan Müller
2. Prof. Dr. Manfred Krifka

Acknowledgements

To write a dissertation is a very (very!) long way to go – but one that is full of wisdom and fun. And although almost nobody considers his dissertation as completed at the day it is being handed in, there must be a day you just stop writing it in order to earn money and see people again. On this long trip, there are always uncountable many people who accompany you, and make your life easier such that you can concentrate on the important things of life, i.e. nominal phrases. As always, and because the performance of our brains is limited, I will probably forget to mention some of these people in these acknowledgements, and I want to apologise for that in advance. Several people which I am going to name belong to different "gratitude classes". To make this section short I am going to name each person only once.

First of all – and not because it is customary to do so – I want to thank my supervisors Stefan Müller and Manfred Krifka from whom I have learnt a lot. Thanks for all the comments, discussions, for being an inexhaustible source of knowledge.

I want to express my gratitude to the staffs of the institutions in which I had the pleasure to work during this period: the German department at the Potsdam University; the Institute of German Language and Linguistics at the Humboldt-University of Berlin (especially: Monika Strietz – my first linguistics teacher); the Institute of German and Dutch Languages and Literatures at the Free University Berlin, and the German department at the Eberhard Karls Universität Tübingen (especially: Sarah Zobel and Claudia Maienborn who gave me the opportunity to work there in the last part of my dissertation). Part of this work was funded by the Deutsche Forschungsgemeinschaft (DFG) during my work at the Collaborative Research Centre 632.

For many enlightening hours of discussion, for comments after talks, for literature recommendations, etc., I want to express my gratitude to: Anke Lüdeling, Anne Temme, Berry Claus, Constantin Freitag, Doug Arnold, Elodie Winckel, Frank van

Eynde, Heiko Seeliger, Lars-Erik Zeige, Marlijn Meijer, Nathalie Scherf, Norbert Fries, Sebastian Bücking, Sören Schalowski, and to the members of the reading groups *Gebrauchsbasierte Grammatiken*, *SySe*, and *SySe Subset*, which always motivated and inspired me along the way with interesting discussions and sharing the fun doing linguistics in the spare time.

I have (and want) to thank as well my friends and colleagues (in alphabetical order): Anna Shadrova, Antonia Strutz, Arvid Andres, Beate Bergmann, Edith Scheifele, Eva Schlachter, Florian Zipser, Julian Rott, Luise Hiller, Oliver Martín-López, Rico Andres, Robert Fritzsche, Robyn Kerkhof, Thomas Krause, and Sophia Döring.

My parents (in alphabetical order) Antonio Torres, Monique Machicao y Priemer, and Ralf Sippel and my family supported me on this long way and understood that the last year(s) of my dissertation I would be the invisible member of the family. Thanks for that.

But first and foremost, I have to express my gratitude to Felicitas Enders who accompanied me, discussed with me, supported me, and was always there since the very beginning of this journey. I am more than lucky to know you at my side.

To all of them, and to them, which I have forgotten to name: I am infinitely grateful!

As always, “alle enthaltenen Fehler sind von mir”

Abbreviations

All abbreviations used in this work – except the ones for glosses in examples – are listed below. For glossed examples, I am following the norms and abbreviations supplied by the *Leipzig Glossing Rules* (cf. Comrie et al., 2015).

1	first person (type)
2	second person (type)
3	third person (type)
acc	accusative (type)
adj	adjective (type)
AG	agent (attribute)
AgrOP	agreement object phrase
AgrSP	agreement subject phrase
a.o.	among others
AP	adjective phrase
ARG	argument (attribute)
arg	argument (type)
ARG0	argument0 (attribute)
arg_exp	argument_expressed (type)
arg_nexp	argument_not_expressed (type)
ARG-ST	argument-structure (attribute)
AVM	attribute-value-matrix
BAG	Bay Area Grammars
BEN	benefactor (attribute)
BG	background (attribute)
bool	boolean (type)
C-INDS	contextual-indices (attribute)
CaseP	Case Principle
CAT	category (attribute)
cf.	confer (= compare)
CG	Categorial Grammar
CN	complex event nominal
CoCoP	Principle of Contextual Consistency
COMPS	complements (attribute)
CONT	content (attribute)
CONX	context (attribute)
CP	complementiser phrase
CS	conceptual structure

dat	dative (type)
DECL	declension class (attribute)
decl	declension class (type)
det	determiner (type)
DET	determiner
DM	Distributed Morphology
DLR	Description Level Lexical Rules
DP	determiner phrase
DPR	Discourse Referent Principle
DR	discourse-referents (attribute)
DTR	daughter (attribute)
e.g.	exempli gratia (= for example)
elist	empty list (type)
est	established (type)
EXP	experiencer (attribute)
expl	expletive-index (type)
fem	feminine (type)
fem-infl	nominal declension class: feminine (type)
fin	finite (type)
GB	Government & Binding Theory
GEND	gender (attribute)
gend	gender (type)
gen	genitive (type)
GPSG	Generalized Phrase Structure Grammar
GTOP	global-top (attribute)
HCONS	handle-constraints (attribute)
HFC	Head Feature Convention
HFP	Head Feature Principle
HD-DTR	head-daughter (attribute)
HPSG	Head-Driven Phrase Structure Grammar
ID	immediate dominance
IDP	Immediate Dominance Principle
i.e.	id est (= that is)
IND	index (attribute)
ind	index (type)
ind-event	index-or-event (type)
inf	infinite (type)
INI	initial (attribute)
INST	instance (attribute)
IPA	International Phonetic Alphabet
i.r.	intended reading
KP	case phrase
LBL	label (attribute)
LEX-DTR	lexical daughter (attribute)

LFG	Lexical Functional Grammar
LOC	local (attribute)
LTOP	local-top (attribute)
LP	linear precedence
LRS	Lexical Resource Semantics
lx_acc	lexical-accusative (type)
lx_dat	lexical-dative (type)
lx_gen	lexical-genitive (type)
lx_nom	lexical-nominative (type)
MARKP	Marking Principle
masc	masculine (type)
MGG	Mainstream Generative Grammar
MLR	Meta Level Lexical Rules
MOD	modified (attribute)
MRS	Minimal Recursion Semantics
mrs	minimal recursion semantics (type)
n_decl	nominal declension class (type)
n_mixed	nominal declension class: mixed (type)
n_pl_strong	nominal declension class: plural & strong (type)
n_pl_weak	nominal declension class: plural & weak (type)
n_sg_strong	nominal declension class: singular & strong (type)
n_sg_weak	nominal declension class: singular & weak (type)
n_strong	nominal declension class: strong (type)
n_weak	nominal declension class: weak (type)
NC	nominal complex
nelist	non-empty list (type)
neut	neuter (type)
NH-DTR	non-head-daughter (attribute)
nom	nominative (type)
NONLOC	nonlocal (attribute)
nopt	not-optional (type)
NP	noun phrase
NUM	number (attribute)
num	number (type)
opt	optional (type)
opt_est	optional-established (type)
opt_pcl	optional-particularised (type)
opt_est_pcl	optional-established-particularised (type)

pcl	particularised (type)
PRT	particle
PER	person (attribute)
per	person (type)
PHON	phonology (attribute)
pl	plural (type)
PP	prepositional phrase
ppp	participle-perfect-passive (type)
PRED	predicative (attribute)
PROC	process (attribute)
Q	quantifier (attribute)
QP	quantificational phrase
ref	referential-index (type)
RELS	relations (attribute)
RN	result nominal
RSD	raised (attribute)
S	sentence
semarg	semantic-argument (type)
SemP	Semantics Principle
SF	semantic form
sg	singular (type)
s-infl	nominal declension class: *s*-nouns (type)
SN	simple event nominal
SPEC	specified (attribute)
SPECP	Specified Principle
SPR	specifier (attribute)
SS	syntax-semantics (attribute)
str	structural-case (type)
str_acc	structural-accusative (type)
str_gen	structural-genitive (type)
str_na	structural-nominative-accusative (type)
str_nom	structural-nominative (type)
STTS	status (attribute)
SUBCAT	subcategorisation (attribute)
SUBCATP	Subcategorisation Principle
SUBJ	subject (attribute)
synsem	syntax-semantics (type)
SYNSEM	syntax-semantics (attribute)
TAG	Tree Adjoining Grammar
TH	theme (attribute)
U-LOC	utterance-location (attribute)
USyn-rule	unary syntactic rule
v_decl	verbal declension class (type)
VAL	valence (attribute)

ValP	Valence Principle
vform	verb form (type)
VFORM	verb form (attribute)
viz.	videlicet (= that is to say)
VP	verb phrase
vs.	versus

Summary (English)

The topic of this dissertation are noun phrases (NPs) in German and Spanish, to be more precise: the relation between a head noun and its arguments. The main questions treated in this dissertation are the following:

- How can we model the syntactic relation between a head noun and its arguments?
- How do arguments get their theta roles?
- How can we account for the linearisation of phrases inside the NP?

The theoretical framework used to examine these questions in this dissertation is Head-Driven Phrase Structure Grammar (HPSG) (Pollard and Sag, 1987, 1994). This dissertation is divided into five chapters, which will be summarised in the following.

In the first chapter, I give the motivation for the research question. NPs are discussed intensively in the linguistic literature either from a syntactic or from a semantic point of view. Literature discussing both aspects of NPs at the same time, however, are rather unusual, normally either due to the theoretical framework that is used, or due to the focus of the study. That is the reason I consider both – syntactic as well as semantic aspects of NPs – in the present work and model their interaction within HPSG.

Furthermore, I am doing so while looking at two languages – Spanish and German – that belong to different language families in order to work out their structural commonalities and differences. For instance, Spanish and German differ with respect to case marking and linearisation inside NPs. One of the goals of the present dissertation is to show to which extent similar descriptive means and similar structures can be used to analyse NPs in these two languages.

In the second chapter, I give an introduction into the theoretical framework of HPSG and compare its descriptive means to the descriptive means of generative approaches. In order to facilitate the understanding of the analyses in the following chapters, I explain the main foundational aspects of HPSG and its mechanisms to model linguistic data. HPSG is a surface-oriented, declarative, constraint-based framework. Linguistic objects (words, phrases, and also rules) are decomposed in attributes with their respective values. The attribute-value pairs constraining linguistic objects are modelled as mathematical objects, called feature structures. Furthermore, in this chapter, I explain the basic elements and operations used in

the theory (attributes, values, type hierarchies, feature structures, attribute-value matrices, structure sharing, etc.). It is explained how HPSG conceives principles and rules/constraints (lexical entries, lexical rules, immediate-dominance schemata, etc.) by means of the basic elements and operations in order to give accurate descriptions of linguistic phenomena.

In the third chapter, I discuss four central syntactic concepts: head, argument, adjunct, and specifier. They are essential for this work since the relations they reflect are needed for the explanation of the phenomena in the following chapters. Although, these four concepts are essential for linguistic description and explanation, the terminology in the linguistic literature is not clear. Therefore it is essential for the present work to clarify the terminology and the formalisation of these concepts in a first step. During the discussion of these relations, the HPSG mechanisms to describe them are presented. For instance, the Semantic Principle (SemP), which takes care of transporting the semantic information of the head to the phrase, is introduced. From the morphosyntactic point of view, it is shown how the head values are projected to the phrase by means of the Head Feature Principle (HFP). Moreover, the interplay between SemP and HFP in the different relations are discussed.

In the fourth chapter of this dissertation I am giving analyses for three different phenomena: case marking, optional arguments, and prenominal arguments.

German and Spanish have a different encoding of case. While German case marking is morphological, i.e. the case paradigm is realised by means of affixes, Spanish encodes case by means of (pseudo-)prepositions. I show how morphological and syntactic case marking can be implemented. Morphological case marking is achieved by means of lexical rules that take into account the inflection classes of nouns. The syntactic case marking, on the other hand, needs a syntactic schema (*head-marker-structure*) in order to combine the semantically vacuous marker/preposition *de* with the NP. The resulting phrase in Spanish has the MARK-value of the marker (to avoid recursion), but the marker is neither treated as the syntactic nor as the semantic head of the structure. Hence, Spanish case marking "prepositions" cannot be considered as "real" prepositions, but as *dummy prepositions* (cf. Demonte 1987, Badia 1998, Machicao y Priemer 2014, a.o.), an argument that is further elaborated in the present work. Moreover, I show that the Case Principle assumed in Przepiórkowski (1999: 93–94) can account for morphological as well as syntactic case marking in German and Spanish.

Although case marking strategies in both languages are different, it can be shown that there are many parallels with respect to the role of case marking and its distribution inside of phrases. In order to exemplify this fact, I am using deverbal nominalisations since it is assumed that they show the same argument structure as their verbal counterparts.

For instance, the argument of the deverbal nouns must be in genitive or be case-marked with *de*, respectively. Furthermore, the argument NP must be adjacent to the head noun. while adjuncts (e.g. *mit Tabletten*) cannot appear between head and argument (cf. (1b) and (2b)).

(1) a. die Behandlung [des Patienten] [mit Tabletten]
the treatment the.GEN patient with pills
'the treatment of the patient with pills'

b. *die Behandlung [mit Tabletten] [des Patienten]
the treatment with pills the.GEN patient
'the treatment of the patient with pills' [intended]

(2) a. el tratamiento [de-l paciente] [con pastillas]
the treatment of-the patient with pills
'the treatment of the patient with pills'

b. *el tratamiento [con pastillas] [de-l paciente]
the treatment with pills of-the patient
'the treatment of the patient with pills' [intended]

Another aspect that is discussed in this dissertation is the similarity between nominalisation and passivisation – also mentioned a.o. in Bierwisch (1989: 60) and Grimshaw (1992: 108–112). Building on that, an HPSG analysis for the nominalisation is proposed. Both processes oppress one argument with structural case. Passivisation deletes the subject of the base verb, while in the case of nominalisation only one of the arguments with structural case can be realised postnominally.

How the arguments in the ARG-ST list of a verb or a noun are realised depends on the mapping between the ARG-ST list and the valency lists (SPR, SUBJ, COMPS). This mapping takes place – following Manning and Sag (1998: 125) who analysed the mapping for verbal elements – by means of constraints for nominal stems which map the elements of the ARG-ST list to the valency lists. Since for nominal stems, only one argument with structural case can appear postnominally, I propose to divide the ARG-ST of the noun into three parts: the element which is mapped to the SPR list (normally a determiner), a parametrised list with the arguments with structural case, and a parametrised list with oblique arguments (e.g. PPs). Thus, the constraint for nominal stems with arguments is as follows:

- The first element of the list is mapped to the SPR list.
- Only one element of the parametrised list for structural arguments is mapped to the COMPS list (by means of the relational constraint `member`).
- The complete list of oblique arguments is mapped to the COMPS list after the structural arguments.

This ensures that only one NP with (morphological or syntactic) structural case can appear postnominally, but this does not restrict which argument – in case there is more than one – it has to be such that either the initial "subject argument" or the initial "object argument" can be realised in this position.

The subsequent section gives an analysis of optional arguments based on Jacobs (1994a). First, Jacobs' theory for optional arguments of verbs as well as other approaches for optionality (e.g. Fodor and Fodor 1980, Flickinger 2000, De Kuthy and Meurers 2003) are explained and discussed.

Following Jacob's definition of optional arguments, the intension of a predicate cannot be different after the deletion of the argument. Furthermore, the existence of a referent for the unrealised optional argument is implied by the predicate. Given that, cases such as (3)–(5) are not to be seen as deletion of optional arguments.

(3) a. Er *hängt* [das Bild].
he hangs the picture
'He is hanging the picture up.'

b. Er *hängt*.
he hangs
'He is hanging something up.' [unavailable reading]
'He is hanging' [available reading]

(4) a. Julia *entbindet* [Marco Polo] [von seinem Versprechen].
Julia disengages Marco Polo from his promise
'Julia releases Marco Polo from his promise' [obtained reading]

b. Julia *entbindet*.
Julia disengages
'Julia gives birth to a child.' [obtained reading]

(5) a. Sie *tritt* [ihren Bruder].
she kicks her brother
'She kicks her brother.'

b. Sie *tritt*.
she kicks
'She kicks someone.' [obtained reading]
'She stretches her leg fast.' [obtained reading]

Moreover, elements deleted for discursive-syntactic reasons (e.g. topic drop in German) are not analysed as optional arguments. Therefore, the set of predicates with optional arguments can be restricted, and lexically encoded optionality can be distinguished from discursive-syntactic deletion. I am proposing an HPSG analysis dealing not only with the syntactic aspects of optionality, but I am also taking into account semantic and pragmatic aspects leading to the deletion of arguments. The analysis is based on the attribute STATUS (STTS) which I propose for elements in the ARG-ST list. Building on Jacobs' classification of optionality, STTS can have five different maximal specific values: *nopt*, *opt_pure*, *opt_est*, *opt_est_pcl* and *opt_pcl*. These values are ordered in a type hierarchy allowing the interaction of different factors.

The STTS values of arguments are depending on the predicate, i.e. every predicate determines the STTS values of its arguments. For instance, a verb with obligatory arguments marks every element in its ARG-ST list with the STTS value *nopt*. For verbs with optional arguments, different subtypes of optionality are proposed depending on the conditions for the deletion. For instance, there are verbs such as *heiraten* 'get married' that can omit their internal argument without further restrictions (*opt_pure*) (cf. (6a)). Then there are verbs like *einwilligen* 'agree' that require that the deleted argument has already been introduced in the previous context (*opt_est*) (cf. (6b)). Other verbs such as *geben* 'give' have a strongly restricted context that allows the arguments to be dropped (*opt_pcl*). In (6c), *geben* allows only *cards* and *card players* to be dropped . Moreover, in cases such as (6d) different aspects of optionality can be combined. For instance, the omitted argument must be already introduced in the discourse (cf. (6b)), and it must be a specific kind of object that is allowed to be dropped (*opt_est_pcl*), in this case some kind of *proposal* (similar to (6c)).

(6) a. dass er morgen (jemanden)$_{opt\_pure}$ *heiratet*
that he tomorrow somebody marries
'that he marries somebody tomorrow'

b. dass er (in die Scheidung)$_{opt\_est}$ *einwilligt*
that he in the divorce agrees
'that he agrees to the divorce'

c. dass er (uns)$_{opt\_pcl}$ (die Karten)$_{opt\_pcl}$ *gibt*
that he us the cards gives
'that he deals the cards to us'

d. dass er (den Vorschlag)$_{opt\_est\_pcl}$ *akzeptiert*
that he the proposal accepts
'that he accepts the proposal'

The arguments and the respective STTS values for every lexical entry are stored in its ARG-ST list. In order to delete arguments from the valency lists, I am proposing unary syntactic rules. Depending on the STTS value of the argument further constraints must be added, for instance, the deleted argument must be already introduced in the discourse. With the proposed interaction between lexical marking by mean of STTS values and unary syntactic rules, the need for different lexical items with different valencies for a single lexical entry can be avoided.

For nominal elements, optionality plays an important role. In the literature, different analysis have been assumed (cf. a.o. Bierwisch 1989, Grimshaw 1992, Hartmann and Zimmermann 2003, Bücking 2010).

With respect to German, the discussion often concentrates on the argument vs. adjunct status of postnominal genitive NPs bearing a theta role assigned by the head noun. In some cases, a distinction with respect to the argumental status is drawn between external and internal arguments, the former being considered an adjunct, and the latter an argument. The question concerning the optionality of arguments is closely related to the question concerning the argumental status of NPs. In my thesis, I work with the previously stated analysis of optionality and argue for the general optionality of all arguments of nominal heads.

In the last section, I deal with prenominal genitive NPs that are arguments of the head noun. The questions at issue are: which interpretations are possible in which head–argument combinations; which is the structural position of prenominal genitive NPs; and how does the theta role reach the prenominal NP. With respect to the first question, the examples in (7) show that normally prenominal as well as postnominal genitive arguments can be interpreted with both theta roles (agent and theme) (cf. (7a) and (7b)). But in cases in which both argument NPs are realised, the interpretation is determined (cf. (7c)): the prenominal NP must be interpreted as agent, and the postnominal as theme.

(7) a. Constantins$_{\text{AG/TH}}$ *Behandlung*
Constantin.GEN treatment
'Constantin's treatment'

b. die *Behandlung* Constantins$_{\text{AG/TH}}$
the treatment Constantin.GEN
'the treatment of Constantin'

c. Annes$_{\text{AG/*TH}}$ *Behandlung* Constantins$_{\text{*AG/TH}}$
Anne.GEN treatment Constantin.GEN
'Anne's treatment of Constantin'

d. * die Constantins *Behandlung*
the Constantin.GEN treatment
'the treatment of Constantin' [intended reading]

e. * *Behandlung* Constantins$_{\text{AG/TH}}$
treatment Constantin.GEN
'a/the treatment of Constantin' [intended reading]

With respect to the second question, examples (7d) and (7e) show that the determiner and the prenominal genitive NP are complementary to each other. Assuming the NP hypothesis – in contrast to generative analyses – this thesis discusses two possible analyses for these structures. Firstly, it is possible to analyse the prenominal NP as the head of the DP, as in Fig. 1 (cf. a.o. Jackendoff 1977, Hartmann and Zimmermann 2003). Secondly, it is possible to analyse the prenominal NP as a specifier of a D head, as in Fig. 2 (cf. a.o. Haider 1988, Sternefeld 2006a).
The structure in Fig. 1 has difficulties accounting for case agreement between determiner and head noun. The element in the D head position in Fig. 1 bears genitive case, therefore a nominal head with a prenominal genitive NP in the determiner position would have to be analysed as a genitive NP (cf. too Van Eynde, 2006). Moreover, complex phrases can also be realised as prenominal genitives (e.g. [*eines Arztes*] *Untersuchung* 'a doctor's treatment'). Therefore, given that heads should be syntactically non-complex, the analysis of a prenominal genitive as a D head is less acceptable.

Both counter-arguments for the structure in Fig. 1 are not problematic for an analysis with an empty determiner and a genitive NP as specifier of this determiner (cf. Fig. 2). The case value of the empty determiner is underspecified, so that there is no case conflict with respect to its agreement with the head noun. Furthermore,

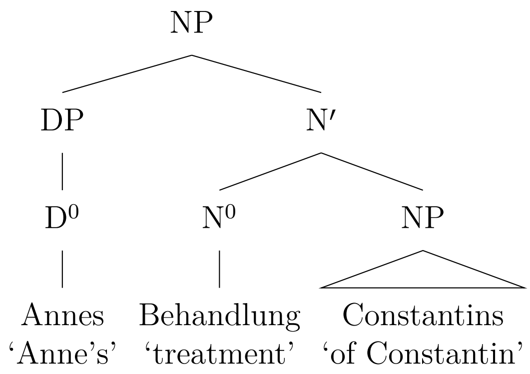

Figure 1: Pre-nominal genitive as D^0

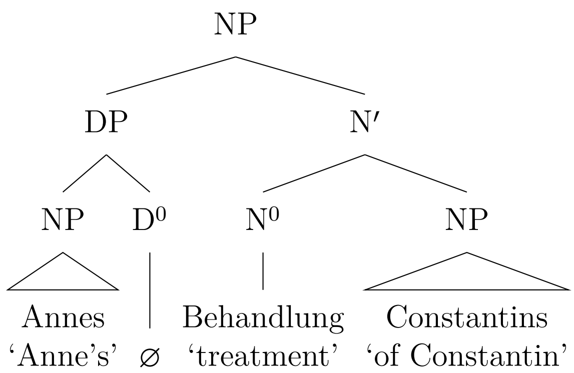

Figure 2: Pre-nominal genitive as specifier of specifier

the specifier position of the determiner allows complex phrases in this position, in contrast to a head position. Therefore, I am assuming that the empty determiner licenses the prenominal genitive NP.

In some varieties of German (e.g. Alemannic and Swabian), similar constructions (cf. *dem Mann sein Buch* 'of the man his book') can be found. In these constructions, the empty determiner is realised by an overt possessive determiner licensing a prenominal NP in dative. Although Standard Spanish does not allow for prenominal genitive NPs, some dialects of Spanish (e.g. in the Andes and Amazonas regions) show constructions in which an overt possessive determiner licenses a *de* marked prenominal NP (e.g. *de la selva su lengua* 'of the forest his language').

Moreover, I show that not only proper names (or definite NPs) (cf. (8a)), but also indefinite NPs (cf. (8b)) are allowed in prenominal position. That fact leads to the conclusion that the definiteness value of the specifier determines the definiteness value of the whole NP.

(8) a. Jeder Gauner hat *Rothschild-s* *Tochter* ausgeraubt.
every trickster has Rothschild-GEN daughter mugged
'Every trickster has mugged Rothschild's daughter.'

b. Jeder Gauner hat *ein-es Bankier-s* *Tochter* ausgeraubt.
every trickster has a-GEN banker-GEN daughter mugged
'Every trickster has mugged a banker's daughter.'

In this thesis, I am proposing an analysis in which the empty determiner takes the definiteness value of its specifier (*Annes* in Fig. 2) and uses it as its own. In this way, NPs such as *Peters Bruders Harley* 'Peter's brother's Harley' can be analysed adequately, such that the definiteness value of *Peters* is used not only for *Bruders* but also for *Harley*.

The structure with the prenominal NP is licensed by a unary syntactic rule that takes an element with structural case from the COMPS list of the noun and puts it in the specifier list of its specifier. With this rule, the prenominal NP is interpreted with its original theta role – by means of structure sharing.

A further phenomenon treated in this thesis concerns the category of pronouns. In contrast to other analyses, I show that nouns are not specified for the 3rd person value, but that the person value of the noun is dependent on the value of the determiner. This analysis is based on Postal (1969), taking pronouns as elements of the category D and not N (cf. (9a) and (9b)).

(9) a. [$_{\text{NP}}$ *Tú* *idiota*] has olvidado recoger-la.
you.2.SG idiot has.2.SG forgotten pick.up-her
'You idiot has forgotten to pick her up.'

b. [$_{\text{NP}}$ *Wir* *Linguisten*] können die Welt retten.
we.1.PL linguists can.1.PL the world save
'We linguists can save the world.'

This dissertation deals with semantic as well as syntactic aspects of the combination of nouns and arguments providing analyses for different phenomena such as: case marking, optionality of arguments, linearisation properties, interpretation of arguments inside the NP, etc. I provide a theory of NPs that is able to account for these phenomena, while alternative approaches are also presented and discussed.

Zusammenfassung (Deutsch)

Thema der vorliegenden Dissertation sind Nominalphrasen (NPs) im Deutschen und Spanischen. Der Schwerpunkt der Arbeit liegt auf der Relation zwischen dem Kopfnomen und seinen Argumenten. Die übergeordneten Fragen der Dissertation sind die folgenden:

- Wie wird die syntaktische Verbindung zwischen dem Kopfnomen mit seinen Argumenten realisiert?
- Wie erhalten die Argumente ihre thematischen Rollen?
- Wie wird die Linearisierung innerhalb der NP gehandhabt?

Für die Beantwortung dieser Fragen wird in der vorliegenden Arbeit die Head-Driven Phrase Structure Grammar (HPSG) (Pollard und Sag, 1987, 1994) als theoretischer Rahmen verwendet. Die Arbeit ist in fünf Kapitel unterteilt, die im Folgenden kurz vorgestellt werden.

Im ersten Kapitel wird die Motivation der Arbeit vorgestellt. Zum einen werden NPs in der linguistischen Literatur sowohl aus semantischer als auch aus syntaktischer Perspektive intensiv diskutiert. Arbeiten, die beide Aspekte zugleich berücksichtigen und vereinigen, sind eher selten. Das liegt i. d. R. am verwendeten theoretischen Rahmen oder am Schwerpunkt der entsprechenden Analyse. In dieser Arbeit werden sowohl semantische als auch syntaktische Aspekte berücksichtigt und deren Interaktion mit Hilfe von HPSG modelliert. Zum anderen werden zwei Sprachen – Deutsch und Spanisch – aus verschiedenen Sprachfamilien betrachtet, um deren strukturelle Gemeinsamkeiten und Unterschiede herauszuarbeiten. NPs im Deutschen und Spanischen unterscheiden sich beispielsweise bezüglich ihrer Kasusmarkierung und ihrer Linearisierungsmöglichkeiten. Eines der Ziele der vorliegenden Arbeit ist zu zeigen, inwiefern gleiche Beschreibungsmechanismen und gleiche Strukturen für die NPs in diesen beiden Sprachen angenommen werden können.

Im zweiten Kapitel der Arbeit wird eine Einführung in den theoretischen Rahmen gegeben und mit generativen Ansätzen verglichen. Dabei werden die Grundlagen und die Beschreibungsmechanismen der Theorie erklärt. HPSG ist ein oberflächenorientiertes, deklaratives, beschränkungsbasiertes Framework. Linguistische Objekte (Wörter, Phrasen, Sätze, wie auch Regeln) werden in Attribute mit dazugehörigen Werten dekomponiert, welche als mathematische Objekte – Merkmalstrukturen genannt – modelliert werden. In diesem Kapitel werden zunächst die

Basiselemente und Operationen der Theorie vorgestellt (Attribute, Werte, Typhierarchien, Merkmalstrukturen, Strukturteilung, usw.), die benötigt werden um die anschließend eingeführten Regeln, Prinzipien und Beschränkungen zu verstehen, mit denen HPSG sprachliche Phänomene modelliert (Lexikoneinträge, lexikalische Regeln, Schemata unmittelbarer Dominanz, usw.). Das Ziel des zweiten Kapitels ist es, zur Verständlichkeit der in den nachfolgenden Kapiteln angegebenen Formalisierungen beizutragen.

Im dritten Kapitel werden vier zentrale syntaktische Begriffe besprochen und diskutiert: Kopf, Argument, Adjunkt und Spezifikator. Sie sind in der Arbeit von besonderer Bedeutung, da die Relationen, die sie darstellen, eine wichtige Rolle für die im nachfolgenden Kapitel angeführten Phänomene spielen. Trotz ihrer Relevanz in der linguistischen Literatur werden diese vier Relationen verschieden interpretiert. Es ist daher für diese Arbeit wichtig, die Terminologie und die Formalisierung dieser Relationen klarzustellen. Bei der Diskussion dieser syntaktischen Hauptrelationen werden die entsprechenden HPSG Mechanismen erklärt, mit denen sie beschrieben werden. So wird beispielsweise das Semantik-Prinzip (SemP) eingeführt, welches dafür sorgt, dass die semantische Information des Kopfes an die Phrase weitergereicht wird. Auf morphosyntaktischer Seite werden die Attribute des Kopfes mit Hilfe des Kopfmerkmalsprinzips (Head Feature Principle, HFP) an die Phrase weitergegeben. Darüber hinaus wird das Zusammenspiel von SemP und HFP bei den einzelnen Relationen exemplifiziert.

Das vierte Kapitel der Dissertation beinhaltet Analysen für drei verschiedene NP-Phänomene: Kasusmarkierung, optionale Argumente und pränominale Argumente.

Deutsch und Spanisch verhalten sich bezüglich der Kasusmarkierung unterschiedlich. Während der Kasus von NPs im Deutschen morphologisch markiert wird, d. h. das Kasusparadigma wird durch Affixe gebildet, wird Kasus im Spanischen syntaktisch mittels „Präpositionen“ markiert. In der Dissertation wird gezeigt, wie die morphologische und die syntaktische Kasusmarkierung implementiert werden kann. Die morphologische Kasusmarkierung von NPs wird durch lexikalische Regeln erzielt, die die Flexionsklasse des Nomens berücksichtigen. Die syntaktische Kasusmarkierung im Spanischen benötigt dagegen ein syntaktisches Schema (*head-marker-structure*), um den semantisch leeren Marker *de* mit der NP zu verbinden, so dass das Resultat der Kombination den MARK-Wert des Markers bekommt, der Marker jedoch weder als syntaktischer noch als semantischer Kopf der resultierenden Struktur gilt. Daher können die Kasus markierenden Präpositionen im Spanischen nicht als „echte“ Präpositionen, sondern als *dummy prepositions* analysiert werden (vgl. Demonte 1987, Badia 1998, Machicao y Priemer 2014, u. a.), ein Aspekt, der in der Arbeit ebenso diskutiert wird. Ebenfalls zeigt die Arbeit, dass mit dem Kasusprinzip – in Anlehnung an Przepiórkowski (1999: 93–94) – sowohl die morphologische Kasusmarkierung im Deutschen als auch die syntaktische Kasusmarkierung im Spanischen mit Hilfe einer Generalisierung erfasst werden kann.

Obwohl die Markierungsstrategien unterschiedlicher Art sind, lassen sich starke Parallelen bezüglich des Auftretens und der Funktion der Kasusmarkierung im Deutschen und Spanischen finden. Um dies zu illustrieren werden deverbale Nomina verwendet, da für diese die gleiche Argumentstruktur wie für ihre verbalen Pendants angenommen wird. So müssen die Argumente des deverbalen Nomens mit dem Genitiv, bzw. mit dem Kasusmarker *de*, markiert werden. Darüber hinaus muss das Argument adjazent zum Kopf erscheinen und ein Adjunkt (z. B. *mit Tabletten*) kann nicht zwischen Kopf und Argument erscheinen (vgl. (10b) und (11b)).

(10) a. die Behandlung [des Patienten] [mit Tabletten]
b. * die Behandlung [mit Tabletten] [des Patienten]

(11) a. el tratamiento [de-l paciente] [con pastillas]
die Behandlung von-dem Patient mit Tabletten
'die Behandlung des Patienten mit Tabletten'
b. * el tratamiento [con pastillas] [de-l paciente]
die Behandlung mit Tabletten von-dem Patient
'die Behandlung des Patienten mit Tabletten' [intendiert]

In der Arbeit wird außerdem die Ähnlichkeit zwischen Nominalisierung und Passivierung gezeigt – u. a. in Bierwisch (1989: 60) und Grimshaw (1992: 108–112) erwähnt – und eine HPSG-Analyse für die Nominalisierung vorgeschlagen. In beiden Prozessen wird ein Argument mit strukturellem Kasus unterdrückt. Im Falle der Passivierung handelt es sich um das Subjekt des Basisverbs, im Falle der Nominalisierung kann nur eins der möglichen Argumente mit strukturellem Kasus postnominal realisiert werden.

Wie die in der ARG-ST-Liste enthaltenen Argumente eines Verbs oder Nomens realisiert werden, ist abhängig von der Zuordnung zwischen der ARG-ST-Liste und den Valenzlisten (SPR, SUBJ, COMPS). Diese Zuordnung erfolgt – in Anlehnung an Manning and Sag (1998: 125), die sich mit dieser Zuordnung im verbalen Bereich befasst haben – mit Hilfe von Beschränkungen für nominale Stämme, die die Elemente der ARG-ST-Liste den Valenzlisten zuordnen. Da im nominalen Bereich nur ein Argument mit strukturellem Kasus postnominal erscheinen kann, wird bei der hier angebotenen Analyse zunächst die ARG-ST-Liste des Nomens in drei Listen geteilt: das Element, welches der SPR-Liste zugeordnet wird (i. d. R. ein Determinierer), eine parametrisierte Liste mit den Argumenten mit strukturellem Kasus, und eine parametrisierte Liste mit den obliquen Argumenten (z. B. PPs). Die Beschränkung für nominale Stämme mit Argumenten besagt dann, dass

- das erste Element der Liste der SPR-Liste zugeordnet wird,
- von der parametrisierten Liste von Argumenten mit strukturellem Kasus nur ein Element der COMPS-Liste zugeordnet wird (anhand der relationalen Beschränkung `member`), und
- die gesamte parametrisierte Liste obliquer Argumente der COMPS-Liste zugeordnet wird.

Damit kann gewährleistet werden, dass nur eine NP mit (morphologischem oder syntaktischem) strukturellem Kasus postnominal erscheinen kann. Dabei wird jedoch nicht beschränkt, welches Argument es sein muss – wenn mehrere vorhanden sind, sodass entweder das „ursprüngliche Subjektargument“ oder das „ursprüngliche Objektargument“ in postnominaler Position möglich ist.

Der anschließende Abschnitt gibt eine Analyse von optionalen Argumenten basierend auf Jacobs (1994a). Zunächst wird Jacobs' Theorie für optionale Argumente im verbalen Bereich vorgestellt und zusammen mit anderen Ansätzen zu Optionalität kommentiert (bspw. Fodor und Fodor 1980, Flickinger 2000, De Kuthy und Meurers 2003).

Nach Jacobs' Definition von optionalen Argumenten darf sich bei Weglassung des optionalen Arguments die Intension des Prädikats nicht ändern, zudem gilt für nicht-realisierte optionale Argumente, dass die Existenz ihres Referenten vom Prädikat impliziert wird. Damit werden Fälle wie (12)–(14) nicht als Tilgung eines optionalen Arguments betrachtet.

(12) a. Er *hängt* [das Bild].
 b. Er *hängt*.

(13) a. Julia *entbindet* [Marco Polo] [von seinem Versprechen].
 b. Julia *entbindet*.

(14) a. Sie *tritt* [ihren Bruder].
 b. Sie *tritt*.

Darüber hinaus werden solche Elemente nicht als optionale Argumente analysiert, welche aus syntaktischen Gründen getilgt werden (z. B. Topik-Drop im Deutschen). Somit kann die Menge der Prädikate eingeschränkt werden, welche optionale Argumente aufweisen, und eine syntaktische Tilgung von einer lexikalisch kodierten Optionalität unterschieden werden. In der Arbeit wird eine HPSG-Analyse vorgeschlagen, die sich nicht nur mit den syntaktischen Aspekten der Weglassbarkeit der Argumente auseinandersetzt, sondern auch semantische und pragmatische Aspekte der Kontexte berücksichtigt, bei denen die Argumente getilgt werden können. Die Analyse basiert auf einem für Argumente definierten Merkmal STATUS (STTS), für welches es fünf verschiedene maximalspezifische Werte – in Anlehnung an Jacobs' Optionalitätstypen – gibt: *nopt*, *opt_pure*, *opt_est*, *opt_est_pcl* und *opt_pcl*. Diese Werte werden in einer Typenhierarchie angeordnet, welche das Zusammenspiel von verschiedenen Faktoren zulässt.

Die STTS-Werte von Argumenten sind vom Prädikat abhängig, d. h. jedes Prädikat legt die STTS-Werte seiner Argumente fest. Beispielsweise markiert ein Verb mit obligatorischen Argumenten jedes der Elemente in seiner ARG-ST-Liste mit dem STTS-Wert *nopt*. Bei Verben mit optionalen Argumenten lassen sich vier Optionalitätskategorien finden, abhängig von den Bedingungen für die Weglassbarkeit. Zum einen gibt es Verben wie *heiraten*, bei denen das interne Argument ohne weitere Restriktionen (*opt_pure*) getilgt werden kann (vgl. (15a)). Darüber hinaus gibt es Verben wie *einwilligen*, die benötigen, dass das getilgte Argument bereits in den Diskurs eingeführt ist (*opt_est*), um ausgelassen werden zu können (vgl. (15b)). Außerdem gibt es Verben wie *geben*, bei denen die Weglassung der Argumente nur in einem stark eingeschränkten Kontext möglich ist (*opt_pcl*), d. h. in einem Kontext, in dem es klar ist, um welche Argumente es sich handelt. Im Falle von *geben* müssen bspw. die Argumente ‚Spielkarten' bzw. ‚Kartenspieler' sein (vgl. (15c)). Fälle wie (15d) vereinigen Aspekte aus (64b) und (64c), indem das getilgte Argument in den Diskurs eingeführt sein muss, und zudem ein spezifisches Objekt (in diesem Fall eine Art ‚Vorschlag') darstellen muss (*opt_est_pcl*).

(15) a. dass er morgen (jemanden)$_{opt\_pure}$ *heiratet*
b. dass er (in die Scheidung)$_{opt\_est}$ *einwilligt*
c. dass er (uns)$_{opt\_pcl}$ (die Karten)$_{opt\_pcl}$ *gibt*
d. dass er (den Vorschlag)$_{opt\_est\_pcl}$ *akzeptiert*

Jeder lexikalische Eintrag hat in seiner ARG-ST-Liste seine Argumente mit den entsprechenden STTS-Werten gespeichert. Die Tilgung der Argumente aus den entsprechenden Valenzlisten erfolgt dann im hier vorgestellten Ansatz mittels unärer syntaktischer Regeln, die je nach STTS-Wert des Arguments verschiedene zusätzliche Beschränkungen hinzufügen, bspw. dass der Referent des getilgten Arguments bereits in den Diskurs eingeführt ist. Mit diesem Zusammenspiel aus lexikalischer Markierung des STTS-Wertes mit unären syntaktischen Regeln für die Tilgung der Argumente wird vermieden, dass im Lexikon verschiedene lexikalische Items mit unterschiedlichen Valenzen für einen einzelnen Lexikoneintrag vorhanden sind.

Optionalität spielt im nominalen Bereich eine wichtige Rolle. Es gibt verschiedene Annahmen bezüglich der Optionalität von Argumenten in NPs (vgl. Bierwisch 1989, Grimshaw 1992, Hartmann und Zimmermann 2003, Bücking 2010, u. a.). Es wird im Allgemeinen über den Argument- bzw. Adjunkt-Status von postnominalen NPs im Genitiv diskutiert, die eine Thetarolle vom Kopfnomen erhalten. Außerdem wird manchmal der Argument-Status bei agentiven vs. thematischen postnominalen Genitiv-NPs differenziert, sodass erstere als Adjunkte letztere als Argumente behandelt werden. Eng mit diesen beiden Punkten verbunden stellt sich die Frage nach der allgemeinen Optionalität von Argumenten einer NP. In der hier vorgestellten Arbeit wird an die angegebene Analyse von Optionalität angeknüpft und für die allgemeine Optionalität aller Argumente von nominalen Köpfen argumentiert.

Im letzten Abschnitt werden pränominale Genitiv-NPs, die Argumente des Kopfnomens sind, analysiert. Es stellen sich dabei die Fragen, bei welchen Kombinationen welche Interpretationsmöglichkeiten der NPs vorhanden sind; welche Position die NP im pränominalen Bereich besetzt; und wie das Argument die pränominale Position erreicht. In Bezug auf die erste Frage zeigen die Beispiele unter (16), dass pränominale wie postnominale Genitiv-NPs prinzipiell beide Argumentrollen (Agens wie Thema) haben können (vgl. (16a) und (16b)). Wenn jedoch beide Argument-NPs auftreten, ist die Interpretation festgelegt (vgl. (16c)), sodass die pränominale NP als Agens und die postnominale als Thema interpretiert werden muss.

(16) a. Constantins$_{\text{AG/TH}}$ *Behandlung*
b. die *Behandlung* Constantins$_{\text{AG/TH}}$
c. Annes$_{\text{AG/*TH}}$ *Behandlung* Constantins$_{\text{*AG/TH}}$
d. * die Constantins *Behandlung*
e. * *Behandlung* Constantins$_{\text{AG/TH}}$

In Bezug auf die zweite Frage zeigen die Beispiele (16d) und (16e), dass der Determinierer und die pränominale Genitiv-NP komplementär sind. Zwei mögliche Analysen – bei Annahme einer NP-Hypothese, anders in neueren generativen Ansätzen – werden in dieser Arbeit diskutiert. Zum einen ist es möglich die pränominale NP als D-Kopf wie in Abb. 3 zu analysieren (vgl. Jackendoff 1977, Hartmann und Zimmermann 2003, u. a.). Zum anderen kann man auch die pränominale NP als Spezifikator eines anderen D-Kopfs wie in Abb. 4 analysieren (vgl. Haider 1988, Sternefeld 2006a, u. a.).

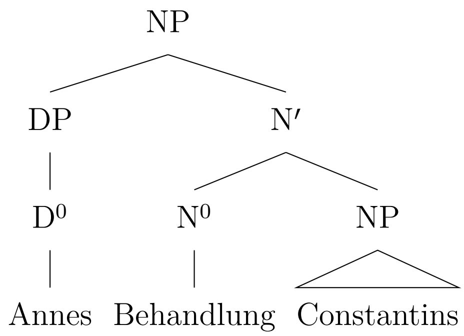

Figure 3: Pränominale Genitiv-NP als D^0

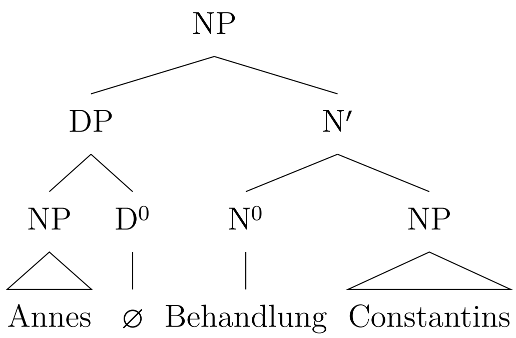

Figure 4: Pränominale Genitiv-NP als Spezifikator des Spezifikators

Die Struktur in Abb. 4.11 ist problematisch auf Grund der Kasuskongruenz zwischen Determinierer und Kopfnomen. Da das Element, welches als D-Kopf fungiert, im Genitiv steht, müssten N-Köpfe mit einem pränominalen Determinierer als Genitiv-NPs analysiert werden (vgl. auch Van Eynde, 2006). Darüber hinaus können die pränominalen Genitive auch komplexere Phrasen darstellen (z. B. [*eines Arztes*] *Untersuchung*). Die Behandlung des pränominalen Genitivs als D-Kopf ist damit auf Grund der strukturellen Komplexität weniger gerechtfertigt. Beide Gegenargumente für die Struktur in Abb. 3 zeigen keine Schwierigkeiten bei einer Analyse mit einem leeren Determinierer und mit der Genitiv-NP als Spezifikator dieses leeren Determinierers (vgl. Abb. 4). Der Kasuswert des leeren Determinierers ist unterspezifiziert, sodass es keinen Konflikt bei der Kasuskongruenz gibt, und die Spezifikatorposition des Determinierers erlaubt, komplexeren Phrasen diese Position zu besetzen. Es wird daher angenommen, dass der leere Determinierer die pränominale Genitiv-NP lizensiert. In einigen Varietäten des Deutschen (z. B. Allemanisch und Schwäbisch) gibt es ähnliche Konstruktionen (vgl. *dem Mann sein Buch*), bei denen ein overter Possessivdeterminierer eine Dativ-NP in pränominaler Position lizensiert. Auch wenn im Standardspanischen pränominale Genitiv-NPs nicht erlaubt sind, gibt es auch dort Varietäten (z. B. in der Andesregion und in der Amazonasregion), bei denen ein overter Possessivdeterminierer eine *de*-markierte pränominale NP lizensiert (z. B. *de la selva su lengua* 'des Urwalds seine Sprache').

Es wird zudem gezeigt, dass nicht nur Eigennamen (oder definite NPs) in pränominaler Position auftreten dürfen (vgl. (17a)). Es sind auch indefinite NPs in dieser Position möglich (vgl. (17b)). Interessanterweise verhält sich die NP mit der pränominalen indefiniten NP im Spezifikator wie ein Indefinitum (vgl. (17b)), während sich diejenige mit einem pränominalen Eigennamen bzw. mit einer pränominalen definiten NP im Spezifikator wie eine definite NP verhält (vgl. (17a)), da der Definitheitswert der gesamten NP vom Definitheitswert seines Spezifikators abhängig ist.

(17) a. Jeder Gauner hat *Rothschild-s Tochter* ausgeraubt.
b. Jeder Gauner hat *ein-es Bankier-s Tochter* ausgeraubt.

In der vorliegenden Arbeit wird eine Analyse vorgeschlagen, mit der der leere Determinierer den Definitheitswert seines Spezifikators (*Annes* in Abb. 4) kopiert und als seinen eigenen verwendet. Damit können NPs wie *Peters Bruders Harley*, bei denen sich die Definitheit von *Peters* sowohl bei *Bruders* als auch bei *Harley* auswirkt, korrekt analysiert werden. Die Struktur mit der pränominalen NP wird von einer unären syntaktischen Regel lizensiert, die ein Element mit strukturellem Kasus aus der COMPS-Liste des Nomens zum Spezifikator des Spezifikators macht. Damit wird diese pränominale NP (durch Strukturteilung) mit seiner ursprünglichen Thetarolle interpretiert.

Ferner wird in der Arbeit gezeigt, dass Nomina nicht für die 3. Person spezifiziert sind, sondern dass der Personenwert erst vom Determinierer bestimmt wird. Diese Analyse basiert auf der Annahme in Postal (1969), welche besagt, dass Pronomina Elemente der Kategorie D und nicht N sind (vgl. (18a) und (18b)).

(18) a. [NP *Tú idiota*] has olvidado recoger-la.
du.2.SG Idiot hast.2.SG vergessen abholen-sie
'Du Idiot hast vergessen sie abzuholen.'

b. [NP *Wir Linguisten*] können die Welt retten.

Die vorliegende Arbeit befasst sich also mit semantischen und syntaktischen Aspekten der Kombination aus Kopfnomen und Argument. Dabei werden verschiedene Analysen geliefert, die sich mit Kasusmarkierung, mit der Optionalität von Argumenten, mit den Linearisierungsmöglichkeiten, und mit der Interpretation der Argumente innerhalb von NPs befassen. Es wurden zahlreiche Alternativansätze diskutiert und eine Theorie der NPs vorgestellt, die die bereits erwähnten Phänomene modellieren kann.

Contents

1 Introduction

Noun phrases (NPs) are an intensely discussed topic in linguistics both from a semantic as well as from a syntactic perspective. Normally, only one of both perspectives is adopted, this usually has to do with the "nature" of the regarded phenomenon and with the theoretical framework adopted for the analysis.

When I first started studying linguistics, I was fascinated by the idea of an inventory of universal principles which generates grammatical utterances and rules out the ungrammatical ones. I have to admit that I was disappointed by noticing that there was not a such "cookbook" for language. By and by, I noticed how difficult it is to give an adequate analysis of the most simplistic phrases, and learnt that if something does not work, then "it must be in the lexicon".

In the present work, I am dealing with NPs in a lexicalist theory, Head-Driven Phrase Structure Grammar (HPSG). I chose HPSG for many different reasons, but I will mention only two of them. Firstly, its architecture – its feature geometry – allows the linguist to regard many different aspects of a phenomenon at once. That is, syntactic, semantic, and pragmatic aspects, for instance, can be analysed in one single linguistic sign (i.e. a morpheme, a word, a phrase, a rule). The modularity, in the way assumed in Mainstream Generative Grammar (MGG),[1] which proposes a strict division of the system, is not taken for granted in HPSG. Moreover, the interaction of the different subsections of the grammar (lexicon, syntax, semantics, pragmatics, etc.) can be modelled easily, since they all are inherent in the feature structure of linguistic objects. Hence, HPSG enables to explore the limits of the core-periphery distinction, without the need of banishing idiosyncratic phenomena to the lexicon, but rather being able to incorporate the idiosyncratic facts into

[1]I am using the term Mainstream Generative Grammar to refer to the family of frameworks emerged in the Chomskyan tradition, i.e. Transformational Grammar, Government & Binding Theory, Minimalism, a.o. In cases in which I refer to a special subkind of MGG, I will disambiguate the term. The differences and similarities between MGG and HPSG will become clear in the course the of next chapter.

the description. Secondly, HPSG is one of the most used formal frameworks in computer implementation of grammars. That is to say, at least the *possibility* of such a "cookbook" as mentioned before is provided by the system and the HPSG community.

I have divided this work into three main parts additionally to this introduction. Firstly, in Chapter 2, I am giving an introduction to HPSG. There, I am going to explain the core ideas of HPSG, the basic structure of the framework, and its mechanisms of description, which will be needed in order to understand the analyses given in the following sections. In the course of this introduction, HPSG and its fundamental ideas will be compared to other frameworks – normally but not only to MGG – in order to work out differences and similarities.

Secondly, in Chapter 3, I am discussing basic notions used in syntactic theory, namely: *head*, *argument*, *adjunct*, and *specifier*. The discussion of these notions is made on the basis of general (and sometimes contradictory) aspects and diagnostics given in the literature to define the properties which distinguish each of these notions from each other. I am regarding semantic as well as syntactic aspects of these notions. At the end of each subsection, I will provide a way to describe each of these notions and distinguish the notions from each other in HPSG.

Thirdly, in Chapter 4, I am going deeper into the analysis of nominal arguments inside NPs. I have decided to analyse NPs contrastively in German and Spanish manly because they belong to different language families (viz. Romance and Germanic) exhibiting at first glance differences in their NP structures and degrees of complexity. Interestingly, however, there are also many parallels in the way their structures can be analysed. For instance, German and Spanish use two different mechanisms with respect to case marking, the former marking its case morphologically, and the latter (mainly) syntactically by means of "prepositions" (cf. Sections 4.3.3 and 4.3.4). This fact must be analysed with different descriptive devices. But nevertheless both languages show regular patterns with respect to structural and lexical case assignment, which is observable not only in verbal but also in nominal phrases.

Furthermore, I am providing an analysis of optionality of arguments based on the account given in Jacobs (1994a) (cf. Section 4.4). In this section, I compare Jacobs' analysis to other accounts provided in the literature, and explain the different circumstances under which cases of optionality can arise, comparing optionality with other phenomena. Subsequently, I give an account for optionality in HPSG and expand it from optionality within VPs to optionality within NPs (cf. Section 4.5). With respect to NPs, the topic of optionality is a much discussed topic. Many different positions have been adopted, from denying the argumental status of further NPs – treating them generally as modifiers – to the assumption that some nouns have obligatory arguments. I will discuss these conflicting approaches with data from German and Spanish event nominalisations.

In the last section of the analysis, I will focus on pre-nominal genitives (cf. Section 4.6). Pre-nominal genitives are mostly of interest in German, since the standard variety of Spanish does not exhibit this structure. The questions that arise in this section concern (a.o.): the structure within the specifier of the NP; which element can be considered the head in the specifier position of the head noun; how to account for the constituent order – with respect to theta-roles – within the NP; and how to account for the (in-)definiteness marking when pre-nominal genitives are realised. Furthermore, I will commit myself to a structure in a Spanish dialect which also shows a pre-nominal genitive. The analysis of this structure will be analysed by means of the same mechanisms applied to the German cases.

This work provides arguments for the idea that theoretical work needs a grammatical formalism in order to achieve comparable structures which at the end of the day tells us something about linguistic structure, and – if you will – about our linguistic competence. I think that the descriptive device provided by HPSG, and its ability to conjoin core grammatical with peripheral phenomena fits best the descriptive adequacy – often admonished in MGG, see for instance Haspelmath (2010) – without loosing its high degree of accuracy in the formalism.

A short note on the data

In cases in which data were difficult to achieve by means of introspection, the following three corpora of the *Real Academia Española* were used:

- Corpus de referencia del español actual (Real Academia Española (2008a), abbreviated as CREA (2008a)),
- Corpus de referencia del español actual – versión anotada (Real Academia Española (2008b), abbreviated as CREA (2008b)),
- Corpus del español del siglo XXI (Real Academia Española (2015), abbreviated as CORPES (2015))

Further, the following two subcorpora of the *Corpora from the Web* (COW) for Spanish and German were consulted:

- ESCOW (Schäfer and Bildhauer (2012), abbreviated as (ESCOW 2012))
- DECOW (Schäfer (2015), abbreviated as (DECOW 2015))

2 The framework: Head-Driven Phrase Structure Grammar

Head-Driven Phrase Structure Grammar (HPSG) belongs to a subclass of generative frameworks, the so-called *Unification Grammars*[1], that was developed predominantly at the Stanford University in the San Francisco Bay Area, and at the Hewlett-Packard laboratories in Palo Alto.[2] The most widespread frameworks belonging to the family of Unification Grammars are – besides HPSG – Generalized Phrase Structure Grammar (GPSG), Lexical Functional Grammar (LFG), Categorial Grammar (CG), and Tree Adjoining Grammar (TAG).[3] The work on HPSG began in the 1980s and was mostly developed by Carl Pollard and Ivan Sag (1987; 1994) emerging from work made in GPSG (cf. Gazdar et al., 1985).

Similar to GPSG, HPSG divides grammatical rules into *immediate dominance* (ID) and *linear precedence* (LP) *rules*, they are, hence, also referred to as ID/LP grammars. That is, constraints on constituent structure and on constituent order regularities are treated separately in order to avoid the inflexibility that results from context-free phrase structure grammars when keeping both sets of rules together (cf. Klenk 2003: 125 and Müller 2016a: 179f), and in order to capture generalisations of ID and of LP separately, since they are not necessarily interwoven (cf. Sections 2.5.3 and 2.5.4).

Furthermore, HPSG and GPSG are surface oriented, not assuming deep structure, empty elements, and transformations as explanatory means, or at least avoiding them as far as possible – in comparison to approaches in MGG. Thus, HPSG is

[1]Unification Grammars are also named constraint-based or declarative grammars, these three terms will be explained in the course of the following sections.

[2]Hence unification grammars are sometimes named Bay Area Grammars (BAG) or are seen as belonging to the so-called West Coast linguistics (cf. Fries and Machicao y Priemer, 2016a; Machicao y Priemer, 2016).

[3]For a synopsis of these frameworks, see Klenk (2003), Müller (2016a), and Kertész et al. (2019).

considered as a *non-derivational* framework, since it does not derive a surface structure from a more abstract underlying deep structure by means of transformations; and in addition it is *declarative*, that means that there is no rigid order of derivation processes, which has to be assumed in a procedural framework (cf. Section 2.3). Therefore in HPSG, there is no necessity to postulate different grammatical systems for production and comprehension, since the order of application of rules would need to be inverted in a comprehension system coming from a production system and vice versa (cf. Pollard and Sag, 1994: 11ff).

Another difference from MGG which is closely related to the surface orientation of HPSG concerns the competence-performance distinction. HPSG does not separate a priori the so-called performance phenomena from the analysis of the language competence. HPSG sees itself rather as a competence grammar compatible with performance phenomena (cf. Sag and Wasow, 2011). Therefore, a grammatical system in the sense of HPSG must be able to describe regular phenomena as well as to give descriptions of irregular ones.[4] Hence, it should be able to integrate the so-called performance factors into the descriptive system, giving at the end an explanation for different acceptability judgements of two similar, but structurally different expressions, due to the comparison of (un-)satisfied constraints (cf. Pullum and Scholz, 2001: 26ff). According to that, the kind of grammatical system resulting from that point of view does not correspond any more only to a so-called *core grammar*, which can be seen as a system containing universal and language specific rules for regular phenomena, but also as a system able to deal with so-called peripheral, i.e. irregular, phenomena.[5] The concept of core grammar in contrast to a periphery in HPSG is thus not seen as a dichotomy given a priori, but as a continuum. The classification of linguistic phenomena as core or peripheral phenomena is seen as gradual. That is to say, a binary answer cannot be given, but the grammatical system can assign a *degree of coreness* to the phenomenon under investigation depending on how widespread a generalisation may be (cf. Müller, 2014b).

HPSG is modelled as a strongly lexicalised framework, i.e. most of the relevant linguistic information is located in the lexicon, simplifying in that way the phrase

[4] See for instance, the analysis of idioms by Richter and Sailer (2009) and how they integrate their theory into an HPSG system.

[5] See Nolda et al. (2014) for a discussion on the treatment of the core-periphery distinction in different frameworks.

structural component, in contrast to its predecessor GPSG (cf. Flickinger et al., 1985: 262). Linguistic objects of all kinds (e.g. words, phrases and even rules) are treated as signs in the spirit of Saussure (1916), i.e. form and meaning are always represented conjoined, in comparison to a strong modularity hypothesis in MGG; and their descriptions are systematically stored in the (abstract) lexicon using the same formal mechanisms of description for all of them (cf. Müller, 2016a: 297), which will be explained in the following sections (cf. Section 2.5). Although HPSG is a lexicon-based framework analysing core as well as peripheral phenomena, its analyses are by no means *ad hoc*. The organisation of the abstract lexicon allows predictions and generalisations of all kinds of linguistic objects due to a type hierarchy which reflects different levels of abstraction (cf. Section 2.2).

In the remainder of this chapter, first the concept of deconstructing linguistic information into attributes and their respective values, that is, their modelling as descriptions of feature structures, will be explained (cf. Section 2.1). In Section 2.2, it will be shown how feature structures are organised in inheritance hierarchies such that generalisations can be obtained. In Section 2.3 the concepts of *unification* and *declarative system* will be explained, since both concepts are considered as fundamental for the theory, and as the main difference to other frameworks.

In the last two Sections (cf. 2.4 and 2.5), first the structure of attribute-value-matrices (AVMs) and the mechanism of structure sharing will be illustrated. Thereupon, the different kinds of constraints with which linguistic phenomena are modelled will be clarified.

According to this summary of the HPSG formalism, the following chapters will treat several phenomena and give an analysis in a declarative, constraint-based way (cf. too Müller and Machicao y Priemer, 2019).

2.1 Feature structures, attributes and values

As mentioned in the past section, HPSG is seen as an exemplar of the frameworks belonging to the "family" of Unification Grammars[6] (cf. Pollard and Sag, 1994: 19). Linguistic objects in Unification Grammars are decomposed into grammatical characteristics, called *attributes* or *features* and its respective *values*. These attribute-

[6] The term Unification Grammar to describe the HPSG formalism is sometimes contrasted to constraint-based approach. The mathematical foundations of the distinction between these two denominations of the formalism can be seen in Richter (2000).

value pairs are modelled as mathematical objects, called *feature structures* (cf. Sag et al., 1986: 238).[7] While a feature structure of a linguistic object is intended to contain *all* properties of the object, linguistic approaches deal only with *partial descriptions of feature structures*, since not every single property of a linguistic object is needed in order to describe a linguistic phenomenon.[8] A partial description of a feature structure used in HPSG is expressed by means of an *attribute-value-matrix* (AVM). Example (1) shows a partial (and rather simplistic) description, i.e. an AVM, of the German word *Tischen* 'tables'.

(1)
$$\begin{bmatrix} \textsc{case} & \textit{dative} \\ \textsc{number} & \textit{plural} \\ \textsc{gender} & \textit{masculine} \\ \textsc{person} & \textit{3} \\ \textsc{content} & \textit{table} \\ \textit{noun} & \end{bmatrix}$$

The AVM in (1) is a set of attributes (in (1): CASE, NUMBER, GENDER, PERSON, CONTENT) and of their respective values (in (1): *dative, plural, masculine, 3, table*). Per convention, attributes are marked with small caps and values with italics. Furthermore, every AVM is surrounded by square brackets and receives a type (in (1): *noun*), which is localised at the lower left corner[9] in italics. In Section 2.4, it will be shown that there is an underlying structure to the ordering of information inside the AVMs, that is to say that an AVM is not just a bag of unordered attribute-value pairs. In fact, by virtue of typification of feature structures its internal structuring of information is determined. This will be further explained in the following section.

[7] In other frameworks, different notions are used for feature structures, e.g. *f-structures* in LFG, and *feature bundles*, *feature matrices*, or *categories* in GPSG (cf. Shieber, 1986: 12ff). The basic idea, however, stays the same.

[8] For a more detailed explanation of feature structures, descriptions of feature structures, and their model-theoretical foundations, see for instance Pollard and Sag (1994: 6ff & 15ff) and Müller (2016a: 197ff & 489ff).

[9] Depending on the notational variant, types can also be localised at the upper left corner. See Bildhauer (2014) for some more explanations on HPSG notational variants.

2.2 Types and inheritance hierarchies

The abstract lexicon in HPSG is structured by means of a *type hierarchy*. Every single feature structure, which in HPSG is a model of a linguistic object (and not the linguistic object itself[10]), is of a specific *type*, therefore being called *typed feature structures*.[11] The type of a feature structure specifies which attributes the feature structure must contain. So, in the simplistic example (1), the type *noun* specifies that the attributes CASE, NUMBER, GENDER, PERSON and CONTENT have to be in the structure.[12] Since every attribute-value pair can be considered as a feature structure itself, every value of an attribute must be assigned a certain type as well. In most cases, the name of the attribute and the name of the type of its value are equal (cf. example 2). Some types are not defined as having further attributes, but only a value (of a specific type). Compare, for instance, the type *noun*, which in the simplistic example (2) is defined as having the further attributes CASE, NUMBER, etc.; in contrast the attribute-value pair CASE is not defined by further attribute-value pairs. These attribute-value pairs, which do not have a subdivision, are called *atomic feature structure* and the types of their values are called *atoms* (cf. Pollard and Sag, 1994: 19). Taking examples (2) and (3), the types of the values of each attribute are given in (2), and in (3) the attributes with specific values are expressed.

(2) $\begin{bmatrix} \textsc{case} & \textit{case} \\ \textsc{number} & \textit{number} \\ \textsc{gender} & \textit{gender} \\ \textsc{person} & \textit{person} \\ \textsc{content} & \textit{content} \\ \textit{noun} & \end{bmatrix}$

(3) $\begin{bmatrix} \textsc{case} & \textit{dative} \\ \textsc{number} & \textit{plural} \\ \textsc{gender} & \textit{masculine} \\ \textsc{person} & \textit{3} \\ \textsc{content} & \textit{table} \\ \textit{noun} & \end{bmatrix}$

Therefore, it can be said that for instance [CASE *case*] in example (2) or [CASE *dative*] in example (3) are *atomic feature structures*, and the values *case* in (2) or

[10]See Pollard and Sag (1994: 6ff) a.o. for an explanation of the model-theoretic basis of HPSG.

[11]In the literature, so for example in Pollard and Sag (1994: 8ff), types are sometimes called *sorts*, hence typed feature structures are also named *sorted feature structures*.

[12]This holds only for the simplistic example given here, and not for the type *noun* in general as will be shown in the subsequent sections.

dative in (3) are *atoms*,[13] while the feature structure with the type *noun* is not atomic.

As a consequence of every attribute-value pair – which is not subdivided into further attribute-value pairs – being modelled as an atomic feature structure, it can be said that feature structures can be embedded in other feature structures defining them. The feature structure of type *noun* in (3) is in this special case a set which contains the other five (atomic) feature structures. I will come back in Section 2.4 to the advantages of modelling linguistic objects by means of embedded feature structures.

Furthermore, every value of an attribute must be explicitly defined, being of a specific type. That means that values without types are not allowed in HPSG, and all types are hierarchically ordered in the grammar. Figure 2.1 shows an abstraction of the hierarchical ordering of types in the grammar.

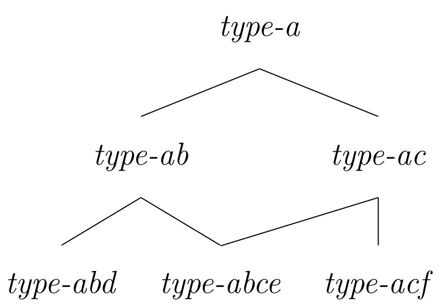

Figure 2.1: Type hierarchy

The *type hierarchy* with the specific definitions of the types is named *signature* and it reflects the ontology of the linguistic objects described by the grammar. That means that types which are higher in the hierarchy (e.g. *type-a* in Figure 2.1) are more abstract, since less constrained, than types lower in the hierarchy (e.g. *type-abd* in Figure 2.1). This is due to the fact that all attribute-value pairs of a higher type are inherited by its subtypes, and that constraints applying to higher types affect also their subtypes. This characteristic of inheritance hierarchies is called *monotonicity*, since the inherited information cannot be deleted or transformed, but only further specified.[14] In order to exemplify this organisation, we

[13]The attribute CONTENT is *not* atomic. Until now, it has been illustrated as such just for expository purposes, as it will be shown in later sections.

[14]For a short discussion on non-monotonic hierarchies sometimes used in HPSG, see Müller

take the type hierarchy from Figure 2.1, and add attributes specific to each type (cf. Figure 2.2).[15]

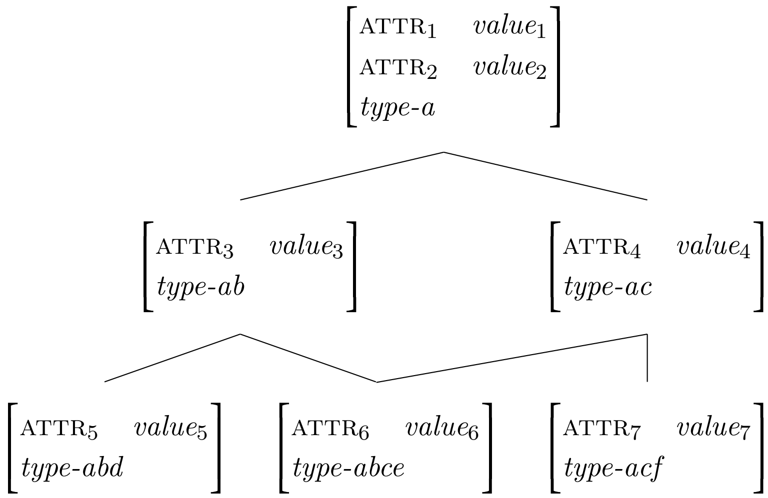

Figure 2.2: Type hierarchy with attributes

In Figure 2.2, *type-a* is defined by the following set of attribute-value pairs: {⟨ATTR$_1$, *value*$_1$⟩, ⟨ATTR$_2$, *value*$_2$⟩}. *type-a* has two subtypes *type-ab* and *type-ac* which inherit the attributes-value pairs of its supertype. That is to say, given the hierarchy in Figure 2.2, a linguistic object which is of *type-ab* will be modelled by the list of the following attribute-value pairs: {⟨ATTR$_1$, *value*$_1$⟩, ⟨ATTR$_2$, *value*$_2$⟩, ⟨ATTR$_3$, *value*$_3$⟩}. For the sake of exposition, let us assume that *type-a* is *noun*, and *type-ab* and *type-ac* are *common noun* and *proper noun*, respectively. Therefore, common nouns and proper nouns share some properties (i.e. ⟨ATTR$_1$, *value*$_1$⟩ and ⟨ATTR$_2$, *value*$_2$⟩), they must for instance bear case and gender. On the other hand, they show some differences, e.g. proper nouns refer to unique entities, while common nouns normally refer to non-unique entities and this could be represented by the different attribute-value pairs: ⟨ATTR$_4$, *value*$_4$⟩ and ⟨ATTR$_3$, *value*$_3$⟩, respectively.

Also, constraints can apply to the more abstract type affecting its subtypes, or apply only to the subtype (and its respective subtypes) not affecting the supertype. Let us for example imagine a constraint that licenses the concatenation of a

(2013a: 114ff).

[15] Type hierarchies are normally given without attribute-value pairs. In Figure 2.2, the attribute-value pairs are given only for the purpose of illustration.

determiner with a common noun, but not with a proper noun. Such a constraint must be defined only for objects of *type-ab* (our imaginary common nouns), but not for *type-ac*, and would not be defined for *type-a*, and by virtue of inheritance, this constraint would also affect linguistic objects of *type-abd* and *type-abce*.

Since the types at the bottom of the hierarchy (e.g. *type-abd*) do not have subtypes, they are maximally specific and are therefore called *maximal types*. To say that they are *maximal* means that these types are the most specific in the hierarchy, since they receive the attributes of all their supertypes. Feature structures modelling linguistic objects must always have a maximal type, i.e. they have to be maximal specific (cf. Pollard and Sag, 1994: 17ff). However, *descriptions of feature structures* do not need to be maximal, for instance some attributes do not have to be spelled out, or some values can be kept *underspecified*. Let us consider an example of this. Take the German words *Wagen* 'car'/'cars' in (4) and *sein* 'his'/'its' in (8) as an example. The lexical entry of *Wagen* is underspecified with respect to number, since it can be singular as well as plural (cf. 4a vs. 4b).

(4) a. Der *Wagen* ist rot.
the.SG car.SG is red

b. Die *Wagen* sind rot.
the.PL car.PL are red

In this case, the value of the attribute NUMBER in the lexical entry has to be the underspecified *number*, which has two subtypes *singular* and *plural*, leading to the type hierarchy in Figure 2.3.

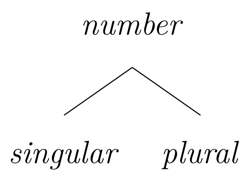

Figure 2.3: Type hierarchy for number

At this point, I should briefly point out the difference between the linguistic object *Wagen* and its AVM. As it was mentioned above, feature structures modelling linguistic objects must be maximal specific. In (4a) and (4b), we are dealing with two different linguistic objects which have each a maximal specific AVM – one in singular, and the other in plural. But, in order to avoid an inflationary increase of lexical entries and to capture generalisations in the lexicon, underspecification is an elegant solution, which allows us to give an underspecified description of the lexical entry of *Wagen* such as in (5). Therefore, the AVM in (5) shows the underspecified value *number*, for the NUMBER attribute.

(5)
$$\begin{bmatrix} \textsc{case} & \textit{nominative} \\ \textsc{number} & \textit{number} \\ \textsc{gender} & \textit{masculine} \\ \textsc{person} & \textit{3} \\ \textsc{content} & \textit{car} \\ \ldots & \\ \textit{noun} & \end{bmatrix}$$

In accordance to other phrase-structure building constraints, the AVM in (5) will lead to the AVMs in (6) and (7) which would be fully[16] specified AVMs of the respective linguistic objects in (4a) and (4b), respectively.

(6)
$$\begin{bmatrix} \textsc{case} & \textit{nominative} \\ \textsc{number} & \textit{singular} \\ \textsc{gender} & \textit{masculine} \\ \textsc{person} & \textit{3} \\ \textsc{content} & \textit{car} \\ \ldots & \\ \textit{noun} & \end{bmatrix}$$

(7)
$$\begin{bmatrix} \textsc{case} & \textit{nominative} \\ \textsc{number} & \textit{plural} \\ \textsc{gender} & \textit{masculine} \\ \textsc{person} & \textit{3} \\ \textsc{content} & \textit{car} \\ \ldots & \\ \textit{noun} & \end{bmatrix}$$

How the specified AVMs arise and how constraints work, will be explained in Sections 2.3 and 2.5. For the time being, just let us observe that the combination of the masculine, singular, nominative determiner *der* and the agreement with the verb in singular in example (4a) allows only for one of the two interpretations, namely (6), but not (7).

Now, we concentrate on the other example of underspecification: *sein* ‘his’/‘its’. Taking a look at the type hierarchy for number in Figure 2.3, we could substitute the name of the type *number* with *singular-or-plural*, since this is exactly what *number* means (at least for English, German, or Spanish, which do not have further

[16] To keep the explanation short and clear, let us assume that the dots “. . . ” in (6) and (7) are *all* further needed attributes with its respective fully specified values.

number values like "dual"). That is to say, a description (e.g. AVM (5)) with the value *number* is not further specified with respect to the NUMBER attribute, and can be used as *singular* or *plural*. In fact, supertypes stand always for an *atom* which has the same meaning as the *disjunction* of their subtypes. Therefore, to use the disjunction in the type name, e.g. *singular-or-plural*, is done just in order to remind which are the subtypes of this underspecified type. Now, having this in mind, a type hierarchy for gender such as in Figure 2.4 would not be helpful to deal with the ambiguity of *sein* showed in example (8).

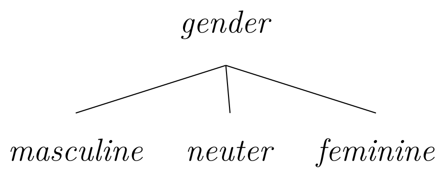

Figure 2.4: Type hierarchy for gender (preliminary)

(8) a. Der Mann liegt auf *sein*-em Rücken.
the.M man lies on POSS.M-DAT back
'The man lies on his own back.'

b. Das Buch liegt auf *sein*-em Rücken.
the.N book lies on POSS.N-DAT back
'The book lies on its own back.'

c. Die Frau liegt auf {**sein*-em / *ihr*-em} Rücken.
the.F woman lies on POSS.N/M-DAT / POSS.F-DAT back
'The woman lies on her own back.'

Since *sein* can refer to a masculine (cf. (8a)) as well as to a neuter (cf. (8b)), but not to a feminine possessor (cf. (8c)), it is not possible to use *gender* as the underspecified type for the lexical entry of *sein*. In contrast, the type hierarchy in Figure 2.5 with the underspecified type *masculine-or-neuter*[17] would provide the desired result.

Now, there is another way to underspecified the values of attributes. In fact, neither a type hierarchy in Figure 2.5 nor the type hierarchy in Figure 2.4 would be helpful to describe an object which can be regarded as feminine or neuter since there

[17]It is common to find different notations for disjunctive types in type hierarchies, e.g. the notation we used: *masculine-or-neuter* or just: *masculine_neuter*.

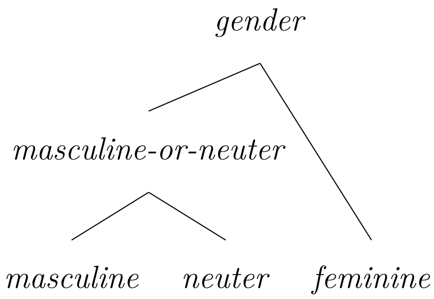

Figure 2.5: Type hierarchy for gender

is no supertype *feminine-or-neuter* in the former, and *gender* is to unrestricted in the latter. But, as it is shown in example (9), the German word *Mädchen* ‘young girl’, although it is inherently neuter, can be referred to by a feminine or a neuter pronoun (cf. Müller, 2013a: 216f).

(9) a. Das Mädchen liegt auf *sein*-em Rücken.
the.N young.lady lies on POSS.N-DAT back
‘The girl lies on her own back.’

b. Das Mädchen liegt auf *ihr*-em Rücken.
the.N young.lady lies on POSS.F-DAT back
‘The girl lies on her own back.’

The possible solutions for this problem are, firstly, to have different lexical entries for *Mädchen*, one for each adequate GENDER value; or secondly, to use a *disjunction* (∨) for the possible GENDER values of *Mädchen*, as shown in AVM (10).[18]

[18] A third possible solution would be to eliminate disjunction and build more complex type hierarchies. This was proposed and implemented in Flickinger (2000) for purposes of efficiency in processing. This third possibility has the advantage to capture some further language-specific generalisations (cf. Flickinger, 2000: 19–20), but as far as I can see, it does not help to capture cross-linguistic generalisations, since a type hierarchy becomes a completely language-specific object.

(10) $$\begin{bmatrix} \text{CASE} & \textit{nominative} \\ \text{NUMBER} & \textit{singular} \\ \text{GENDER} & \textit{feminine} \vee \textit{neuter} \\ \text{PERSON} & \textit{3} \\ \text{CONTENT} & \textit{young girl} \\ \ldots & \\ \textit{noun} & \end{bmatrix}$$

As can be seen, HPSG captures linguistic generalisations by means of ontological structuring of linguistic information in the type hierarchy, which according to its property of inheritance, explained at the beginning of this section, is considered an inheritance hierarchy.[19] The structure of a type hierarchy reflects consequently vertical generalisations of linguistic information, offering a possibility to postulate constraints at different levels of abstraction depending on the degree of specificity of the type. For instance, constraints on nouns or on the more concrete type of common nouns can be postulated, according to what is needed for a particular phenomenon. Furthermore, multiple inheritance, i.e. when a subtype has two (or more) supertypes, is also possible and often needed (cf. *type-abce* in Figure 2.1).[20] In cases of multiple inheritance, the subtype inherits all attribute-value pairs and constraints of all its supertypes, therefore no incongruences between attributes and constraints of the supertypes are allowed, otherwise yielding to a contradiction (cf. Section 2.3) and thereby being ruled out by the grammar.

2.3 Unification and declarative systems

As already mentioned in at the beginning of Section 2, HPSG belongs to the family of the so-called Unification Grammars, which are named after its most predominant operation: *unification*, notated with $\sqcup$. All sub-kinds of Unification Grammars make use of attribute-value pairs to model linguistic objects; unification is the operation with which the information contained in two (or more) different descriptions of feature structures can be merged into one single structure (cf. Sag et al.,

[19] Other sub-kinds of Unification Grammars such as GPSG, TAG, or CG do not use inheritance hierarchies as a means for generalisations. See Müller (2016a: 668) for an overview and discussion.

[20] We will see an example of multiple inheritance with respect to Figure 2.7 in Section 2.5.1.

1986; Shieber, 1986). Taking for example (11) and (12) as two AVMs of the same linguistic object, we can see that both contain different amounts of information. While (11) contains information about CASE, NUMBER, and GENDER of the object, (12) tells us something about CASE, NUMBER, and PERSON, leaving the attribute GENDER to some extent underspecified, as seen in the previous section.

(11) $$\begin{bmatrix} \textsc{case} & \textit{dative} \\ \textsc{number} & \textit{plural} \\ \textsc{gender} & \textit{masculine} \\ \textit{noun} & \end{bmatrix}$$

(12) $$\begin{bmatrix} \textsc{case} & \textit{dative} \\ \textsc{number} & \textit{plural} \\ \textsc{gender} & \textit{masculine-or-neuter} \\ \textsc{person} & \textit{3} \\ \textit{noun} & \end{bmatrix}$$

According to that, the unification of (11) and (12) is the AVM in (13), which contains *all* attributes of the unified AVMs, but nothing more than that.

(13) $$(11) \sqcup (12) = \begin{bmatrix} \textsc{case} & \textit{dative} \\ \textsc{number} & \textit{plural} \\ \textsc{gender} & \textit{masculine} \\ \textsc{person} & \textit{3} \\ \textit{noun} & \end{bmatrix}$$

In order for AVMs to be unifiable, they – i.e. their attribute-value pairs – have to be compatible (cf. Pollard and Sag, 1987: 36ff). That means,

1. their information must be equal (cf. CASE in (11) and (12)), or
2. the information of one of them is more specific, than the information of the other, i.e. below in the type hierarchy (cf. GENDER in (11) and (12)), or
3. there is information in one structure, which is not included in the other one (cf. PERSON in (11) and (12)).

In the last two cases (items 2 and 3), the additional or more specific information is taken for the output structure in (13). Assuming the type hierarchy for gender in Figure 2.5, we can see that the value *masculine* is more specific than *masculine-or-neuter*. Moreover, since a typed feature structure is defined as having specific attributes, the structure in (11) actually contains the attribute PERSON with the value *person*, but since it is maximal unspecific it is not given in the structure but by definition assumed. Thus, items 2 and 3 can be considered as the same case.

Given the conditions above, the unification of the attribute-value pairs of the AVMs in (11) – here repeated as (14) – and (15) fails, since both are not compatible with respect to the value of NUMBER. Their values are neither equal, nor is *plural* less specific than *singular* (or vice versa), nor is NUMBER an attribute in one AVM not included in the other.

(14) $$\begin{bmatrix} \textsc{case} & \textit{dative} \\ \textsc{number} & \textit{plural} \\ \textsc{gender} & \textit{masculine} \\ \textit{noun} & \end{bmatrix}$$

(15) $$\begin{bmatrix} \textsc{case} & \textit{dative} \\ \textsc{number} & \textit{singular} \\ \textsc{gender} & \textit{masculine} \\ \textit{noun} & \end{bmatrix}$$

In addition, a further main aspect of Unification Grammars concerns their property of being *declarative* by virtue of unification (cf. Shieber, 1986: 11f). Declarative systems deduce resulting structures from defined facts, in comparison to so-called procedural or derivational systems such as MGG. That means, that declarative systems define primarily which associations are allowed between form and meaning of a linguistic object (i.e. word, phrase, rule, etc.) and states them as a fact, while derivational systems define predominantly how these associations can be computed (cf. Shieber, 1986: 6f). The following example (16) will be used to illustrate both terms (cf. Kiss, 1995: 10f).

(16)
a. S → NP VP
b. VP → V NP
c. NP → Guido
d. NP → Michael
e. V → loves

Interpreted *derivationally*, (16a) states that in a structure, a node S is *substituted* by the two daughters NP and VP, as proposed in Chomsky (1965: 66ff).

Interpreted *declaratively*, the same rule in (16a) states a *fact*, more specifically, it states the description of a local structure S, consisting of an NP and a VP. As long as a derivational system is interpreted as a substitutional, non-monotonic system – i.e. a system which derives a structure *X* from a structure *Y* by *changing* some aspects of *Y* – then this system will depend on the order of rule applications. For instance, it is not possible to apply (16b) first, and then (16a) to get a sentence such as (17),[21] since the substitution in (16b) bleeds the possible input for (16a).

(17) Guido loves Michael.

Furthermore, rule-order dependent systems can lead to spurious ambiguities by applying the same rules, but in different orders, additionally they must postulate different grammatical systems for production and comprehension of one and the same structure. The independence from the order of rule applications can thus be considered as one major advantage of declarative over derivational systems. In such systems, it is sufficient to state the rules as facts, the system works in all directions, being able to deduce the result structure from the parts, or the parts from the result (cf. Sag et al. 1986: 252f; Kiss 1995: 10f; Pullum and Scholz 2001: 32f; a.o.).[22]

2.4 Structuring information and structure sharing

In this section, it will be exemplified how AVMs are organised. As already seen, AVMs represent sets of attribute-value pairs which describe the required characteristics of linguistic objects. It has been mentioned at the beginning of Section 2 that HPSG does not work modular in the same sense as MGG does. That is to say, HPSG does not separate the derivation of expressions into different subsystems – i.e. deep-structure, surface-structure, phonetic form and logical form – which are independent from each other (cf. Chomsky, 1981: 17ff). In HPSG, linguistic objects are rather modelled as signs following the sign conception of Saussure (1916: 76ff) with all properties together not being divided derivationally into grammatical subsystems. Thus, HPSG models signs as descriptions of feature structures with all the phonological, syntactic, and semantic information of the linguistic object represented altogether in one AVM.[23] In terms of the architecture of the system, the

[21] The same order dependency is known from phonetic-phonological rules as treated in Generative Phonology (cf. Chomsky and Halle, 1968).

[22] So-called *declarative* programming languages such as Prolog or Lisp are often used in grammar implementations based on HPSG. However, since "by nature" computers work procedurally, declarative languages are actually a *simulation* of a declarative system.

[23] Depending on the focus of the analysis, also pragmatic (cf. for instance Cook 2014), information structural (cf. for instance Song and Bender 2012), and even orthographic information (cf. for instance Bildhauer 2014) can be included in the AVM.

kind of “modularisation” used in HPSG is more akin to the so-called *Parallel Architecture* (cf. Jackendoff 1997: 38ff, Jackendoff 2002: 107ff, and Jackendoff 2011), in which all modules interact which each other at any time. The different “modules” are built into each sign and show the capacity of interaction, which is not per se given in a strong modular and derivational system. For the purpose of explanation, let us take the AVM in (18) which is a more accurate AVM for the word *Tischen* ‘tables’ than the simplistic example previously given in example (1) in Section 2.1.

(18)
$$
\left[\begin{array}{ll}
\text{PHON} & \left\langle \text{t,ɪ,ʃ,ə,n} \right\rangle \\
\text{SYNSEM} & \left[\begin{array}{ll}
\text{LOC} & \left[\begin{array}{ll}
\text{CAT} & \left[\begin{array}{ll}
\text{HEAD} & \left[\begin{array}{ll} \text{CASE} & \boxed{1}\ \textit{dat} \\ \textit{noun} & \end{array}\right] \\
\text{VAL} & \left[\begin{array}{ll}
\text{SPR} & \left\langle \text{DET} \left[\begin{array}{ll} \text{CASE} & \boxed{1} \\ \text{NUM} & \boxed{2} \\ \text{GEND} & \boxed{3} \end{array}\right] \right\rangle \\
\text{SUBJ} & \langle\,\rangle \\
\text{COMPS} & \langle\,\rangle
\end{array}\right]
\end{array}\right] \\
\text{CONT} & \left[\begin{array}{ll}
\text{IND} & \boxed{4} \left[\begin{array}{ll} \text{PER} & \textit{3} \\ \text{NUM} & \boxed{2}\ \textit{pl} \\ \text{GEND} & \boxed{3}\ \textit{masc} \\ \textit{ref} & \end{array}\right] \\
\text{RELS} & \left\langle \left[\begin{array}{ll} \text{INST} & \boxed{4} \\ \textit{table} & \end{array}\right] \right\rangle \\
\textit{mrs} &
\end{array}\right] \\
\text{CONX} & \textit{context}
\end{array}\right] \\
\text{NONLOC} & \textit{nonlocal}
\end{array}\right] \\
\textit{word} &
\end{array}\right]
$$

As already mentioned with respect to example (3) in Section 2.2, feature structures can be embedded in other feature structures. In example (18), the description of the sign, which in this case is of type *word*, is divided into phonological and syntactic-semantic information.

The phonological information is represented as the value of the attribute PHONOLOGY, abbreviated as PHON.[24] The value of PHON (of type *list*) is a list of phonemes. Elements of a list are given in angled brackets ⟨ ⟩. In more elaborated phonological analyses, PHON contains more complex representations (cf. Bildhauer 2007 for an overview). For the sake of readability, we will use the orthographic form (i.e. ⟨*Tischen*⟩) instead of the phonological form (i.e. /tɪʃən/) as is customary in HPSG analyses that are not dealing with phonological aspects.[25]

The SYNTAX-SEMANTICS attribute (SYNSEM) encompasses the syntactic and semantic information of a linguistic object. Since only a special sort of information is important for the combination of objects – more precisely: for selectional restrictions – this information is grouped in SYNSEM, i.e. SYNSEM contains the information that can be selected by other constituents, in contrast to the information under PHON, which is not relevant for selectional purposes.[26]The attribute SYNSEM is again divided into LOCAL (LOC) and NONLOCAL (NONLOC). LOC contains information relevant for local contexts only, i.e. only inside a phrase, and NONLOC for long-distance dependencies, e.g. quantifier floating, extraction phenomena, etc.

LOC is divided into three attributes: CATEGORY (CAT) bundles syntactic, CONTENT (CONT) semantic and CONTEXT (CONX) contextual information. The syntactic information in CAT is divided into HEAD and VALENCE (VAL).

HEAD contains the information relevant to the part of speech of the sign, thus its value is of type *part-of-speech* (*pos*), with *noun* and *verb* being subtypes of *pos*. It is commonly assumed – despite the theoretical framework (cf. Section 3.1) – that in complex structures, the features of the structural head are projected to the whole phrase. These features are thus grouped under the feature HEAD, which is shared by the structural head and its maximal projection. How the projection of

[24]Due to issues of space, attributes in AVMs are normally given in their abbreviated forms. Subsequently, abbreviations will be given in brackets in their first use. Afterwards, only the abbreviations will be used. Further attributes will be introduced and explained in subsequent sections.

[25]In those rare cases in which we use phonological forms, this will be explicitly marked with the phonological bracketing in forward slashes, e.g. /tɪʃən/ and with the IPA transcription.

[26]At least not in "regular selection" of arguments. The value of PHON is indeed important in so-called idiomatic expressions like *kick the bucket* since the meaning 'to die' is only achieved if *kick* selects an object with the PHON value *the bucket*. For a comparison of both regular vs. constructional selection, see Jacobs (2009).

head features is handled in HPSG will be shown in Section 2.5.5 (cf. Head Feature Principle in (47) and (48)). Depending on the part of speech, different attributes will have to be projected; while verbs will project their attribute VERBAL FORM (VFORM, with its possible values: *finite* (*fin*), *infinite* (*inf*), etc.), nouns will project CASE (with its possible values (for German): *nominative* (*nom*), *accusative* (*acc*), *dative* (*dat*), and *genitive* (*gen*)). According to the type of the value of HEAD – *verb* or *noun* – we will deal with an AVM such as (19) for the former or as (20) for the latter (cf. Müller, 2013a: 56ff).

(19) $\begin{bmatrix} \text{VFORM} & \textit{vform} \\ \textit{verb} & \end{bmatrix}$

(20) $\begin{bmatrix} \text{CASE} & \textit{case} \\ \textit{noun} & \end{bmatrix}$

The VAL attribute whose value is of type *valence* (*val*) is divided into three attributes SUBJECT (SUBJ), COMPLEMENTS (COMPS), and SPECIFIER (SPR) whose values are of type *list*. It is worth pointing out that Pollard and Sag (1994) assume a different internal structure of the CAT attribute in Chapters 1–8 than in Chapter 9. In the first chapters, CAT groups the attributes HEAD and SUBCATEGORIZATION (SUBCAT), and SUBCAT has as its value the list of arguments of the sign. In the last chapter, SUBCAT is replaced by the attributes SUBJ, COMPS, and SPR making a distinction between the possible kinds of arguments and not including all of them into one single list. This distinction can be seen as a great advantage, since not all arguments of a sign show the same behaviour (cf. Borsley 1987a and Borsley 1987b for an overview). For instance, in HPSG it is common to analyse the determiner as being selected by the noun – i.e. as a kind of "argument" of it – but determiners and other noun arguments differ in many respects, e.g. in their linearisation properties, therefore the split of the SUBCAT list can be regarded as well justified (cf. Section 2.5.4 to see an example of that).[27] I am adopting here the latter, more differentiated view, and group the valence attributes under VAL as explained in Przepiórkowski (1999: 19–20) and Richter (2000: 329–330). The values of the three lists represent the list of constraints imposed onto the elements which are subcategorised by the sign. That is to say, the values of SPR, SUBJ, and COMPS can be considered as the valence list of the sign described by the AVM.[28]

[27] For some languages such as German, the SUBJ attribute is sometimes not assumed, taking the subject as belonging to the COMPS list. In Kiss (1995: 241ff), the attribute SUBJ is also used for German, but as a HEAD feature.

[28] In some analyses, only the simplistic representation of the valence list, i.e. the SUBCAT attribute,

In our example (18), the object *Tischen* has neither a subject, nor complements, hence, both lists – under SUBJ and COMPS – are empty. However, *Tischen* needs a specifier which is represented in the list as an abbreviation of the kind of structure selected by the head noun (i.e. DET).[29] The elements of the lists in SPR and COMPS are objects of type *synsem* (cf. Pollard and Sag, 1994: 23). As already mentioned above, only the information under SYNSEM is relevant for selectional purposes, since it is not important whether the selected determiner has the phonological form /deːn/ 'the' or /fiːlən/ 'many', but it is relevant which further syntactic and semantic properties it has. In our case, the only requirement is that it should be a *synsem* of a determiner (abbreviated as DET) which has specific CASE, NUMBER (NUM), and GENDER (GEND) values, namely the CASE, NUM, and GEND values of DET must be *token identical* with the ones of the noun. The AVM in (21) shows an abbreviated AVM of (18) which includes only the relevant attribute-value pairs, but a less abbreviated AVM of the constraints on the specifier.

(21)
$$\left[\text{SYNSEM}|\text{LOC}\ \left[\begin{array}{ll}\text{CAT} & \left[\begin{array}{ll}\text{HEAD} & \left[\begin{array}{ll}\text{CASE} & \boxed{1}\ \mathit{dat}\\ \mathit{noun} & \end{array}\right]\\ \text{VAL} & \left[\text{SPR}\ \left\langle \left[\text{CAT}|\text{HEAD}\ \left[\begin{array}{ll}\text{CASE} & \boxed{1}\\ \text{NUM} & \boxed{2}\\ \text{GEND} & \boxed{3}\\ \mathit{det} & \end{array}\right]\right]\right\rangle\right]\end{array}\right]\\ \text{CONT}|\text{IND} & \left[\begin{array}{ll}\text{NUM} & \boxed{2}\ \mathit{pl}\\ \text{GEND} & \boxed{3}\ \mathit{masc}\end{array}\right]\end{array}\right]\right]$$

The AVM in (21) further shows that the notation for the token identity between the values of two (sub-)structures is represented by indexed boxes (e.g. the CASE value $\boxed{1}$). This representation of identity between (sub-)structures is called *structure sharing* and constitutes one of the most important devices in HPSG and

is used (cf. Müller, 2016a: 258ff). In other analyses, the attributes SPR, SUBJ, and COMPS are not subsumed under VAL, but directly under CAT (cf. Pollard and Sag, 1994: 347).

[29] "DET" in example (18) is *not* a feature, but an abbreviation of a description. Another way to abbreviate the AVM of the determiner is given as the one element of the list of SPR in example (21).

in other declarative frameworks (cf. Kiss 1995: 36ff, Bildhauer 2014: 528f, Müller 2016a: 203ff, a.o.).

The AVMs (22) and (23) show two different ways to mark the equality of values in AVMs, but the notational difference between both is relevant for the theory. For instance, the German word *Tisch* 'table' is underspecified with respect to the value of CASE. It can have the CASE values *nom*, *acc*, or *gen*. Since noun and determiner must agree in their case information, the corresponding determiner selected through the SPR attribute must have the same value as the noun.

(22)
$$\begin{bmatrix} \textsc{synsem}|\textsc{loc}|\textsc{cat} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textsc{case} & nom \vee acc \vee dat \\ noun & \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{spr} & \left\langle \begin{bmatrix} \textsc{cat}|\textsc{head} & \begin{bmatrix} \textsc{case} & nom \vee acc \vee dat \\ det & \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

(23)
$$\begin{bmatrix} \textsc{synsem}|\textsc{loc}|\textsc{cat} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textsc{case} & \boxed{1}\ nom \vee acc \vee dat \\ noun & \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{spr} & \left\langle \begin{bmatrix} \textsc{cat}|\textsc{head} & \begin{bmatrix} \textsc{case} & \boxed{1} \\ det & \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The problem in AVM (22) is that it just constrains the noun to have the CASE value *nom* or *acc* or *gen*, and the determiner to have the CASE value *nom* or *acc* or *gen*, but it does not constrain that the value of the noun and of the determiner must be *identical*. Moreover, by virtue of the disjunction of values,[30] it is possible for this structure to have a noun in nominative, but a determiner in dative. This is ruled out in AVMs (21) and (23) by virtue of structure sharing, than no matter which value the noun has, the determiner will have exactly the same one. Thus, the notational difference between AVM (23) and AVM (22) with respect to the CASE values is relevant, since they constrain different kinds of objects (cf. Müller, 2013a: 217).

Furthermore, since HPSG is not a derivational framework such as MGG, it does not make use of transformations; that means that the relation between two structures with (almost) equal meaning, but different form, is not established by means

[30] The disjunction of values was presented in Section 2.2 as a possibility for underspecified values in AVMs.

of *movement*, but by *identity* yielded through the structure-sharing mechanism. The theoretical assumption of sharing information between two structures (in our case between values of CASE, NUM, and GEND in noun and determiner) is for many reasons a more sophisticated solution than the assumption of transformations[31] (cf. also Section 2.3), I will mention just two of them.[32]

Firstly, as commented by Pollard and Sag (1994: 10), sharing of information between structures (e.g. between filler and gap, anaphor and binder, or predicate and argument) does not have any further theoretical consequences than movement has. A movement account imposes further complications into the grammatical system, since a concept of movement automatically implies ordering issues yielding artificial ordering paradoxes (cf. Sag et al. 1986: 252f, Müller 2013b: 940ff, and the discussion of example (16) above).[33]

Secondly, structure sharing is a very powerful tool in order to explain further linguistic phenomena such as: agreement, government, argument linking, different kinds of "movement", projection of head features, etc. Since one of the tasks of a theoretical framework consists of setting up the mechanical devices or the formalism to produce generalisations which must predict the (un-)grammaticality of structures in a given language, a framework able to explain rather unrelated phenomena without postulating different devices of explanation should be considered as more efficient, because this automatically reduces the complexity of the explanation and achieves a more economic system.

Returning to our example (21), the illustrated identity of values between noun and determiner represents case, number and gender agreement. In the following

[31] It is worth noting that in minimalist accounts the concept of movement has been replaced to some extent by "Form Chain, an operation that forms the full chains [of antecedent and traces; MyP] from the D-Structures [...] in a single step" (Chomsky, 1995: 44). This change in the theoretical paradigm leads to a similarity between the new mechanism and "structure sharing" since no transformational component is needed any more.

[32] I cannot go into the details here of comparing the (dis-)advantages of transformational vs. declarative accounts. For a comparison of older transformational vs. declarative accounts, see Sag et al. (1986). For a comparison of Government and Binding vs. HPSG, see Pollard and Sag (1994), and Müller (2016a). For a comparison of Minimalism and HPSG focussing on the similarities, see Müller (2013b).

[33] I do not want to address the question of empirical motivation for movement, often criticised in MGG approaches, since I do not believe, that what is considered as empirical fact in one framework must hold for another framework as well. Hence, I confine myself to observations with respect to the economy and accuracy of the grammatical *system*.

sections, we will deal with more cases of structure sharing.

With respect to the semantics of the sign, this information is stored under CONT. The internal structure of CONT depends on the framework used for describing the semantics of signs. Here, I am using (a version of) Minimal Recursion Semantics (MRS) (Copestake et al., 2005) which is one of the most widespread semantic frameworks implemented in HPSG that allows for underspecification of scopal phenomena.[34] In the AVM in (24), I am initially giving the relevant semantic information of example (18) in a simplified MRS structure. I am going to work with the simplistic MRS structures in order to keep the AVMs used as simple as possible. Furthermore, this is customary in cases in which scopal underspecification is not relevant (see for instance, Bildhauer 2014).

(24)
$$\begin{bmatrix} \textsc{phon} & \left\langle \text{t,ɪ,ʃ,ə,n} \right\rangle \\ \textsc{synsem}|\textsc{loc}|\textsc{cont} & \begin{bmatrix} \textsc{ind} & \boxed{4}\begin{bmatrix} \textsc{per} & \mathit{3} \\ \textsc{num} & \boxed{2}\ \mathit{pl} \\ \textsc{gend} & \boxed{3}\ \mathit{masc} \\ \mathit{ref} & \end{bmatrix} \\ \textsc{rels} & \left\langle \begin{bmatrix} \textsc{inst} & \boxed{4} \\ \mathit{table} & \end{bmatrix} \right\rangle \\ \mathit{mrs} & \end{bmatrix} \\ \mathit{word} & \end{bmatrix}$$

The value of the attribute CONT is of type *minimal-recursion-semantics* (*mrs*). A substructure of type *mrs* consists of an attribute INDEX (IND) and an attribute RELATIONS (RELS). The value of IND is of type *index-or-event* (*ind-event*), which is a subtype of *semantic-argument* (*semarg*) (cf. Figure 2.6).[35]

The subtypes of *ind-event* contain information about the kind of semantic variable introduced by the object, and has the subtypes: *event* and *index* (*ind*). The subtypes of *ind* are *referential-index* (*ref*) and *expletive-index* (*expl*), a.o. That is to say the value of IND says something about the semantic kind of object the AVM

[34]Pollard and Sag 1987 and 1994 make use of Situation Semantics (cf. Barwise and Perry, 1983). Another common framework using underspecification is Lexical Resource Semantics (LRS) developed by Richter and Sailer (2004).

[35]See Flickinger et al. (2003: 10) for further subtypes of *semarg*.

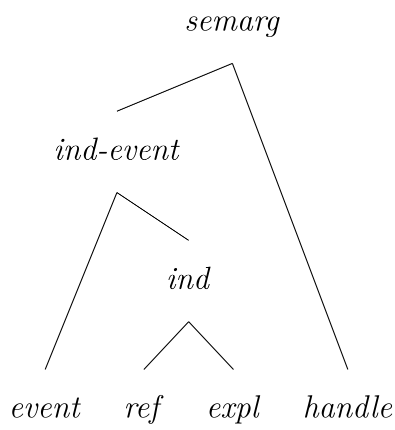

Figure 2.6: Type hierarchy for *semarg*

is describing. For instance, the noun *Tischen* 'tables' in example (24) above is a referential object, i.e. of type *ref*[36], while the IND value of a verb (cf. example (25) below) is of type *event*, since it is commonly assumed – in a Davidsonian tradition (cf. Davidson, 1967) – that verbs introduce event variables.[37]

The substructure of type *ref* group together the attributes PERSON (PER), NUMBER (NUM), and GENDER (GEND) which are *per*, *num*, and *gend* valued, respectively.[38] This information is important for the noun variable introduced by the object for instance in order to establish the correct binding relations of pronouns (cf. Müller and Ørsnes, 2013: 10).

The value of the RELS attribute is of type *list*.[39] The single elements of the RELS list are *elementary predications* (EPs). As defined by Copestake et al. (2005: 283), an EP is

[36]The value *expl* is for expletives like some uses of the pronoun *es* in German which are different from referential objects since they do not have reference (cf. Müller, 2014a).

[37]The term "event" in HPSG is commonly used for "eventuality" in the terminology of Bach (1986: 6), which is a superordinate concept comprising different sorts of events, such as states, processes, culminations, etc. For an overview on event semantics, see Maienborn (2011) and Koenig (2016).

[38]The set of person, number, and gender features in MGG approaches are called ϕ-features (cf. Chomsky, 1981: 330–331). But ϕ-features in MGG are not completely comparable to the attributes under IND, since the set of MGG ϕ-features include also "[...] Case and other features (e.g. perhaps [*wh*-])" (cf. Chomsky 1981: 330–331 and 1995: 35).

[39]To be more precise, the value of RELS is more a *bag* than a *list*, since the order of elements is not relevant. But it is not a *set*, since elements in a bag can be repeated, but not in a set.

> [...] a single relation with its associated arguments (for instance, beyond(x, y)). In general, an EP will correspond to a single lexeme.

That is to say, the preposition *beyond* is represented as a relation or as a predicate *beyond′* with its respective argument variables x and y. EPs of nominal objects bear normally an INSTANCE (INST) attribute which is of the same type as the IND attribute, and the value of INST is structure-shared with the value of IND. The EPs of verbs are normally more complex than the one of nouns, but their description is straightforward. For instance, the lexical entry of the German verb form *schlägt* '(he) beats' in example (25) introduces the EP *beat* which comprises three attributes: EVENT of type *event* – which is structure-shared with and has the same type as the value of IND; AGENT (AG) and THEME (TH) – which are both *index* valued.

(25)
$$\left[\begin{array}{ll} \textsc{phon} & \left\langle \text{ʃ,l,ɛː,k,t} \right\rangle \\ \textsc{synsem}|\textsc{loc}|\textsc{cont} & \left[\begin{array}{ll} \textsc{ind} & \boxed{1}\left[\begin{array}{ll}\textsc{tense} & \textit{present}\\ \textsc{mood} & \textit{indicative}\\ \textit{event} & \end{array}\right] \\ \textsc{rels} & \left\langle \left[\begin{array}{ll}\textsc{event} & \boxed{1}\\ \textsc{ag} & \boxed{2}\ \textit{ind}\\ \textsc{th} & \boxed{3}\ \textit{ind}\\ \textit{beat} & \end{array}\right]\right\rangle \\ \textit{mrs} & \end{array}\right] \\ \textit{word} & \end{array}\right]$$

That means, the relation *beat* represents an event with two theta-roles (or semantic roles): an agent and a theme. The values of AG and TH are structure-shared with the IND values of the arguments of the verb (cf. example (26) below).[40]

[40] In HPSG, it is common to use very specific attributes for theta-roles, e.g. Pollard and Sag (1987: 17) use for the the predicate *give′* the theta-roles: GIVER, GIFT, and GIVEE. Following Copestake et al. (2005: 305), who argue that "[t]his use of such features is [...] incompatible with stating generalisations involving linking between syntax and semantics in lexical entries", I am using the more generalised nomenclature: AGENT, THEME, GOAL, etc. in this work.

2.5 Rules, principles, constraints

Until now, it was only showed how linguistic objects are modelled in HPSG. All explanations were given with respect to words and its attribute-value pairs, but nothing has been said about the way to analyse the concatenation of affixes and stems or of bigger elements than words (e.g. phrases), and how the concept of *constraint* applies.

In Section 2, it was mentioned that in HPSG words, phrases, and rules are described with the same mechanism. The basics of this mechanism have been already exemplified in the past sections. Keeping that in mind, it will now be shown how HPSG deals with the organisation of elements and with generalisations.

HPSG is a constraint-based theory, i.e. all descriptions made in this framework are made by means of constraints. Following Levine and Meurers (2006: 238f) and Müller (2013a: 97f), the set of descriptive constraints can be divided into:

- *lexical entries*, which model minimal elements such as words and morphemes, and whose properties are constrained by typed feature structures;
- *lexical rules*, which license the derivation of complex words (e.g. inflectional and derivational rules);
- *immediate dominance schemata*, which set up the hierarchical constituent structures given in a language;
- *linear precedence rules*, which licence the specific constituent order;
- *grammatical principles*, which represent very general and underlying rules; and
- *relational constraints*

In the following, these different forms of descriptive constraints will be explained and exemplified.[41]

[41] Pollard (2000) states further constraints which can be seen as the *mathematical foundations* of the framework. These are more than *purely grammatical constraints* which are going to be explained here (cf. too Calcagno and Pollard 1995 and Richter 2000).

2.5.1 Lexical entries

Lexical entries and the structure of AVMs have been explained to some extent in Section 2.4 by means of the AVM of a noun (cf. (18)). In this section, some further attributes and values will be introduced focussing on the concepts of constraints and generalisations in lexical entries.

The AVM in (26) is on the one hand far from being a complete description of the German verb form *putzt* 'cleans'. On the other hand, it is already a very complex structure of a word. HPSG is a lexicalist framework, but building a lexicon with so much information in each lexical entry would display a very inefficient grammatical system full of redundant information. Therefore, plenty of the information contained in (26) is actually information that can be captured and generalised by means of constraints (cf. Pollard and Sag, 1987: 193ff).

The information contained in the AVM (26) can be characterised as follows. This AVM constrains that the linguistic object described is of type *word* and has the phonological form (i.e. the PHON value – cf. Footnote 25) /pʊt͡st/. The object must be a finite verb, which do not select for a specifier, but for a subject (cf. SUBJ) and for an object (cf. COMPS).[42] The subject must be an NP in nominative (cf. *nom*), and its IND value is structure-shared with the IND value of the AGENT (AG) of the verb (cf. $\boxed{1}$), i.e. the subject must bear the PER and NUM values *3* and *sg*. With respect to the semantics of the described object, it is an *event* of type *clean*, with an agent and a theme, the IND value of the THEME is structure-shared with the IND value of the complement of the verb (cf. $\boxed{2}$).

[42]Keep in mind that "NP[*nom*]$_{\boxed{1}}$" and "NP[*acc*]$_{\boxed{2}}$" are not AVMs, but just abbreviations for the AVMs of the *synsem* objects subcategorised by the verb.

(26)
$$\begin{bmatrix}
\text{PHON} & \langle \textit{putzt} \rangle \\
\text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{VFORM} & \textit{finite} \\ \textit{verb} & \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \langle\, \rangle \\ \text{SUBJ} & \langle \text{NP}[\textit{nom}]_{\boxed{1}} \rangle \\ \text{COMPS} & \langle \text{NP}[\textit{acc}]_{\boxed{2}} \rangle \end{bmatrix} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{3}\ \textit{event} \\ \text{RELS} & \left\langle \begin{bmatrix} \text{EVENT} & \boxed{3} \\ \text{AG} & \boxed{1} \begin{bmatrix} \text{PER} & \mathit{3} \\ \text{NUM} & \textit{sg} \end{bmatrix} \\ \text{TH} & \boxed{2} \\ \textit{clean} & \end{bmatrix} \right\rangle \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\
\textit{word} &
\end{bmatrix}$$

But, only a small part of the information in AVM (26) is in fact necessary to be listed explicitly in the lexical entry of the described object, namely only idiosyncratic information is really needed. Therefore, just the phonological form of the stem, and its intensional meaning, that is the information under PHON and some information under SYNSEM|LOC|CONT|RELS, must be explicitly spelled out in the lexicon, or in other words: must be explicitly *constrained* in the lexical entry, resulting in an AVM such as (27). All other parts of information contained in (26) and left out in (27) can be inherited from appropriately specified types leading to generalisations.

(27)
$$\begin{bmatrix}
\text{PHON}\ \langle \textit{putz-} \rangle & \\
\text{SYNSEM} \mid \text{LOC} \mid \text{CONT} \mid \text{RELS} & \left\langle \begin{bmatrix} \textit{clean} \end{bmatrix} \right\rangle \\
\textit{root} &
\end{bmatrix}$$

Firstly, for the verb *putzt* to be a finite verb, in 3rd person, singular, in present tense is rather information contributed to the structure by the affix *-t*, similar to *-s* in English verbs. This kind of generalisation will be explained in Section 2.5.2.

Secondly, taking just the root *putz-* (cf. the type *root* of the constraint in (27)), there are some properties which are shared by all verbs. So for instance, all verbs share the properties to belong to the part of speech "verb", more precisely: to be of type *verb*, which is a subtype of *pos*. In addition, all verbs represent a relation of type *event* which is structure-shared with the value of IND. Hence, (28) is a constraint which holds for *all verbs*.

(28)
$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{verb} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{1}\ \textit{event} \\ \text{RELS} & \left\langle \begin{bmatrix} \text{EVENT} & \boxed{1} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

Thirdly, in order to keep the explanation short, let us assume that all mono-transitive verbs have a subject which gets nominative and an object which gets accusative. Furthermore, the subject is the agent of the event realised by the verb, and the object its theme. Therefore, *all mono-transitive verbs* will be constrained by (29).

(29)
$$\begin{bmatrix} \text{CAT}|\text{VAL} & \begin{bmatrix} \text{SUBJ} & \left\langle \text{NP}[\textit{nom}]_{\boxed{1}} \right\rangle \\ \text{COMPS} & \left\langle \text{NP}[\textit{acc}]_{\boxed{2}} \right\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{RELS} & \left\langle \begin{bmatrix} \text{AGENT} & \boxed{1} \\ \text{THEME} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

The kind of constraints explained in (28) and (29) are organised in terms of constraints on types ordered along a type hierarchy, and by virtue of inheritance, these constraints yield an accurate description of linguistic object (cf. Section 2.2). This way of generalising over linguistic properties is called *vertical generalisation*, since "certain properties are common to all words of a single class or subclass" (Meurers, 2001: 161ff). For instance – as explained in Section 2.2 – the properties and constraints which apply to higher types within a type hierarchy affect its subtypes as well (cf. explanation of Figure 2.2). Therefore, taking our example in (26) and the type hierarchy in Figure 2.7, we can state that the constraints applying to the types *verb-sign* and *verb-sem* yield the description in (28). The constraint in (29) is furthermore achieved by the constraints inherited from the types *ag-th-rel*, *nom-acc-arg*, and its respective supertypes. The type *strict-trans-verb-root* inherits, by virtue of *multiple inheritance* (cf. Section 2.2), from all its supertypes achieving a constraint with all mentioned properties for verb roots like *schlag-* 'beat', *ess-* 'eat', or *schlag-* 'beat'.

As can be seen, by virtue of vertical generalisations in form of inheritance hierarchies, the information stored explicitly in lexical entries can be kept as minimal as possible and generalisations are captured along the vertical axis of the type hierarchy reflecting (natural) classes (e.g. verbs and nouns) and subclasses (e.g. transitive and intransitive verbs) with similar behaviour.

2.5.2 Lexical rules

In comparison to constraints postulated in lexical entries and resulting from the inheritance along the type hierarchy, which are called vertical generalisations, lexical rules[43] represent *horizontal generalisations*. They state abstract and "[...] systematic relationship[s] holding between two word classes, or more precisely, between the members of one class and the members of another class" (Flickinger, 1987: 101). For instance, at the beginning of Section 2.5.1, it was postulated that some parts of the information in the AVM (26) was contributed by the affix *-t*, stated now more accurately by the lexical rule which inserts *-t*. Taking the quote of Flickinger (1987: 101), we can describe the relation between the verb stem *putz-* and the verb form *putzt* as a systematic relationship between the members of the class "verb stems" and the members of the class "verb form in 3rd person, singular, in present tense" in general, and not only between the specific forms *putz-* and *putzt*. This relationship represents a generalisation which can be captured through a constraint in form of a lexical rule (cf. AVM (30)).

Lexical rules in general state relationships between two linguistic objects of type *stem* or *word*, i.e. between two words, two stems, or between a word and a stem. The lexical rule in (30) in particular states the relationship between the AVM of a stem to the left – the input of the rule, and the AVM of a word to the right – the output of the rule. This relation is expressed by the symbol $\mapsto$ (cf. Meurers, 2001: 168ff).[44] To be more precise, (30) states a relation between all elements

[43] Lexical rules are also called lexical redundancy rules.

[44] Please remember that the symbol for lexical rules ($\mapsto$) is different from the operator which will

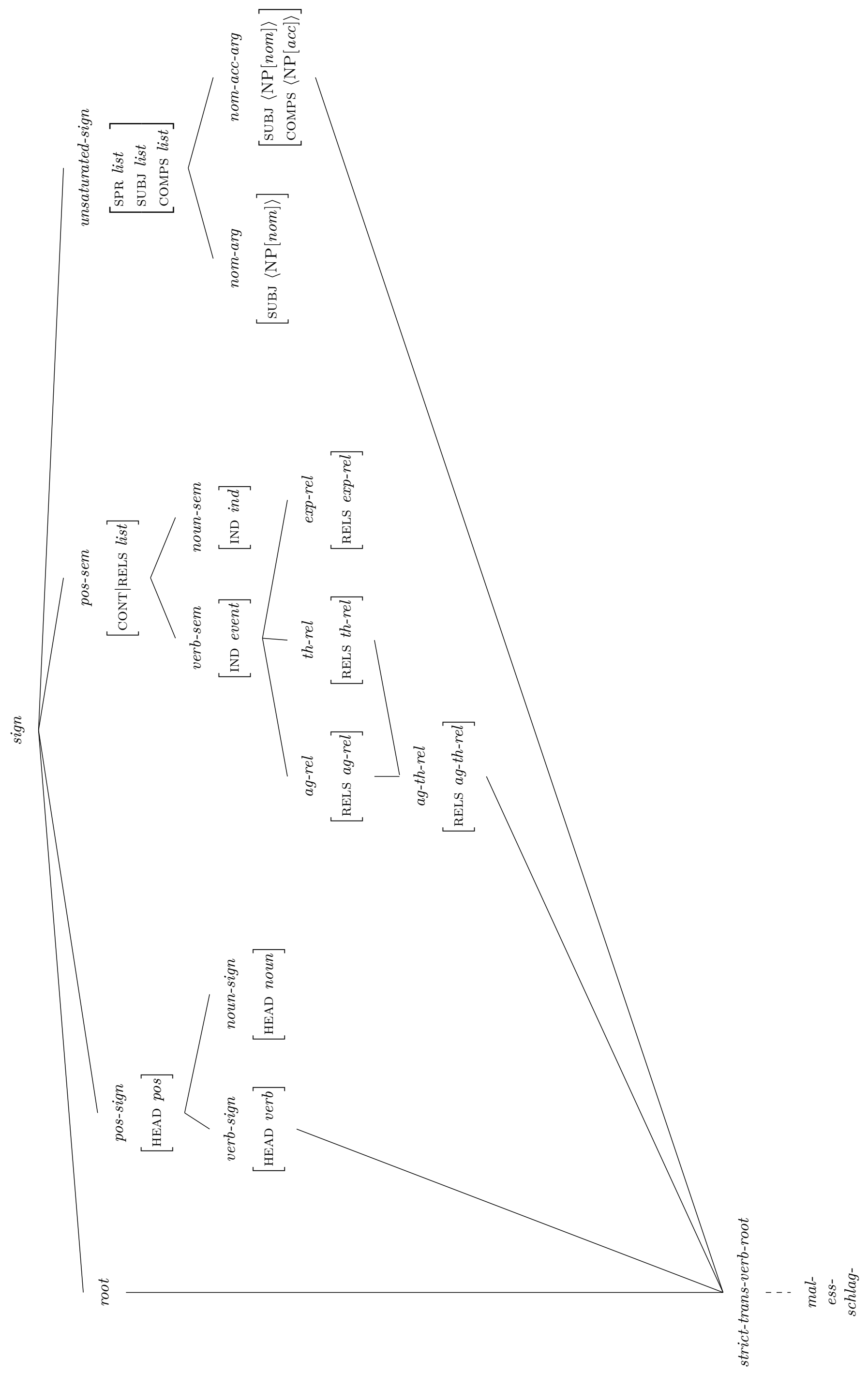

Figure 2.7: Example of vertical generalisations (based on Müller 2013a: 94)

satisfying the constraints posited by the AVM to the left hand of the arrow and all elements satisfying the constraints posited by the AVM on the right hand. Further attribute-value pairs not mentioned in the AVM to the right are carried over to the output as far as they are compatible with the output.

(30) Lexical Rule (MLR): Verb inflection for 3rd person, singular, present

$$\begin{bmatrix} \text{PHON } \boxed{1} \\ \text{SYNSEM}\mid\text{LOC}\mid\text{CAT}\mid\text{HEAD } \textit{verb} \\ \textit{stem} \end{bmatrix} \mapsto \begin{bmatrix} \text{PHON } f(\boxed{1}\,, \langle t \rangle) \\ \text{SYNSEM}\mid\text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \begin{bmatrix} \text{VFORM } \textit{fin} \\ \textit{verb} \end{bmatrix} \\ \text{VAL} \begin{bmatrix} \text{SUBJ} \left\langle \text{XP} \begin{bmatrix} \text{PER } \textit{3} \\ \text{NUM } \textit{sg} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{IND} \begin{bmatrix} \text{TENSE } \textit{present} \\ \textit{event} \end{bmatrix} \\ \textit{mrs} \end{bmatrix} \end{bmatrix} \\ \textit{word} \end{bmatrix}$$

The AVM to the left states that the element must be of type *stem*, and that it has to be a verb (cf. SYNSEM|LOC|CAT|HEAD *verb*). The output must be of type *word*, and the values of the attributes VFORM, TENSE, PER and NUM must be specified as *fin*, *present*, *3*, and *sg*, respectively, that is yielding some finite verb in third person, singular, in present tense that agrees in person and number with its subject (cf. SUBJ). Take into account that not constraining the input AVM for VFORM, TENSE, SUBJ, etc. as in (30) is in this case equivalent to give the maximal *unspecific* constraints as in the following AVM in (31).

be used for *implicational constraints* (→), cf. Section 2.5.3. In the literature, one can sometimes find the double arrow (⟹) instead of ↦, see for instance Pollard (2000).

(31)
$$\begin{bmatrix} \text{PHON}\ \boxed{1} & \\ \text{SYNSEM} \mid \text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{VFORM} & \textit{vform} \\ \textit{verb} & \end{bmatrix} \\ \text{VAL}|\text{SUBJ} & \textit{list} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \begin{bmatrix} \text{TENSE} & \textit{tense} \\ \textit{event} & \end{bmatrix} \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\ \textit{stem} & \end{bmatrix}$$

The function *f* under PHON in the output AVM of the lexical rule 30 calculates the suitable result of the phonological form. *f* takes two lists as arguments. The first one is represented by $\boxed{1}$ which is a variable for any list of phonemes that constitutes the PHON value of the verb stem in the input AVM. The second one is the list built by the ending *t*. Then, *f* concatenates its arguments into one single list, deriving e.g. ⟨/p, ʊ, t͡s, t/⟩ out of the list of the stem ⟨/p, ʊ, t͡s/⟩ and the list of the affix ⟨/t/⟩.[45] All further attribute-value pairs not explicitly mentioned in the lexical rule are meant to be carried over from the input structure into the output structure. To put it in the words of Pollard (2000: 2): "change the input entry only in the ways that the right-hand side of the rule tells us to change it, and leave everything else the same".[46]

A different formalisation of processes below the syntactic level, i.e. of lexical processes, has been proposed in order to formalise them as one single description, integrating them into the general HPSG theoretical framework. The two related AVMs in (30) represent a so-called *Meta Level Lexical Rule* (MLR) which deal with lexical rules and the lexicon as *external* to the theory, i.e. on a meta level, separating the lexicon and its generalisations from the grammatical component

[45] According to Müller (2013a: 378f), the function *f* would make the necessary changes if we are dealing with verb stems needing more than only ⟨t⟩ as the ending of the respective verb form. For instance, the verb stem *arbeit-* 'work' gets concatenated with the affix *-et* in order to derive the verb form in 3rd person, singular, in present tense *arbeit-et* 'works'. In other words, it is *f* which chooses which allomorph has to be used, according to the phonological information of the stem.

[46] Pollard (2000) mentions also that this kind of interpretation of the formalisation conflicts with the fact that lexical rules are not algorithms, but descriptions. See also Calcagno and Pollard (1995).

(cf. e.g. modularisation in MGG). In contrast to MLR, *Description Level Lexical Rules* (DLR) integrate lexicon and lexical rules into the HPSG theory, getting rid of the extra meta-system needed in MLR.[47]

The AVM in (33) shows the DLR formalisation of the lexical rule presented in (30) in MLR format. The DLR format, as already mentioned and as can be seen in (33), is formalised as a single description, without using the ↦ symbol to relate two descriptions. The AVM of the new lexical rule is an object of type *fin-verb-infl-lr* that stands for "lexical rule for inflected finite verb forms". *fin-verb-infl-lr* is a subtype of *word*, therefore all objects licensed by this rule are elements of type *word*. This is important, since this rule cannot apply recursively, i.e. only elements of type *stem* can be inflected through this rule, resulting in an element of type *word* (cf. (32a)). But elements of type *word* – i.e. the result of the rule – cannot be input for this rule again (cf. (32b)), as the following example may illustrate.

(32) a. putz- + -t = putz*t*
clean$_{\text{stem}}$ 3.SG.PRS clean.3.SG.PRS$_{\text{word}}$

b. putzt + -t = * putz*tt*
clean$_{\text{word}}$ 3.SG.PRS clean.3.SG.PRS.3.SG.PRS

Just as the MLR format, the DLR format in AVM (33) can be divided into an input and an output. The new attributes LEXICAL-DAUGHTER (LEX-DTR) and AFFIX represent the inputs of the rule,[48] similar to the left side of the rule in (30). LEX-DTR is constrained to be of type *stem*. The output of the lexical rule is, as already mentioned, an object of type *fin-verb-infl-lr* – a subtype of *word*. The relations between input and output of the rule are represented in (33) only by means of structure sharing (cf. CAT, CONT, and PHON), thereby getting rid of the relation represented by the ↦ symbol.

The lexical rule in (33) can be thought of as a unary tree whose daughter is the sign in the LEX-DTR and whose mother node is the whole structure. Thereby, the PHON value of LEX-DTR and the PHON value of the affix are concatenated into the PHON value of the whole structure. In comparison to phrase structure trees,

[47] A more detailed comparison of DLR and MLR can be found in Meurers (2001: 170ff). Furthermore, the MLR format does not *necessarily* need to be interpreted as external to the theory. An attempt to use the MLR format including lexicon and lexical rules into the theory has been made in Pollard (2000).

[48] Sometimes, instead of LEX-DTR and AFFIX, only the attribute STEM with the output are used. The latter representation reflects better the idea of a unary rule (cf. Wechsler, 2015: 207).

(33) Lexical Rule (DLR): Verb inflection for 3$^{\text{rd}}$ person, singular, present

$$
\begin{bmatrix}
\text{PHON} & f(\boxed{1}\ ,\ \boxed{2}\ ) \\
\text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \boxed{4}\begin{bmatrix}\text{VFORM} & \textit{fin}\\ \textit{verb} & \end{bmatrix} \\ \text{VAL} & \begin{bmatrix}\text{SUBJ} & \boxed{3}\end{bmatrix}\end{bmatrix} \\ \text{CONT} & \begin{bmatrix}\text{IND} & \boxed{6}\begin{bmatrix}\text{TENSE} & \boxed{5}\\ \textit{event} & \end{bmatrix} \\ \text{RELS} & \boxed{7} \\ \textit{mrs} & \end{bmatrix}\end{bmatrix} \\
\text{AFFIX} & \begin{bmatrix}\text{PHON} & \boxed{2}\left\langle \textit{-t} \right\rangle \\ \text{SYNSEM}|\text{LOC} & \begin{bmatrix}\text{CAT}|\text{VAL}|\text{SUBJ} & \left\langle \boxed{3}\ \text{NP}\begin{bmatrix}\text{PER} & \textit{3}\\ \text{NUM} & \textit{sg}\end{bmatrix}\right\rangle \\ \text{CONT} & \begin{bmatrix}\text{IND}|\text{TENSE} & \boxed{5}\ \textit{present}\end{bmatrix}\end{bmatrix} \\ \textit{fin-verb-i-suffix} & \end{bmatrix} \\
\text{LEX-DTR} & \begin{bmatrix}\text{PHON} \left\langle\boxed{1}\right\rangle & \\ \text{SYNSEM}|\text{LOC} & \begin{bmatrix}\text{CAT} & \begin{bmatrix}\text{HEAD} & \boxed{4}\ \textit{verb}\end{bmatrix}\\ \text{CONT} & \begin{bmatrix}\text{IND} & \boxed{6}\ \textit{event}\\ \text{RELS} & \boxed{7}\end{bmatrix}\end{bmatrix} \\ \textit{stem} & \end{bmatrix} \\
\textit{fin-verb-infl-lr} &
\end{bmatrix}
$$

mother and daughter nodes are lexical.[49]

The most important difference between MLR and DLR concerns the idea that MLR relates elements contained in the lexicon. Namely, MLR states that if there is an element satisfying the constraints in the input, there must be also an element in the lexicon satisfying the constraints of the output. The rule itself which states the relation between input and output does not belong to the description language, but is a meta-rule. On the other hand, DLR states also a relation between objects, but the rule itself is an object of the description language, loosely speaking, the rule itself represents the output and to do so it embeds the input (cf. Wechsler, 2015: 206).

2.5.3 Immediate dominance schemata

After looking at constraining on word level, which is handled by lexical rules, in the previous section, we will now look at generalisations over phrasal structures; loosely speaking, we are moving away from morphology and entering syntax.

HPSG, in comparison to MGG, does not make use of tree-configurational notions like c-command for the explanation of possible and impossible syntactic configurations (cf. Bildhauer, 2014: 526f, a.o.). Moreover, as stated in Section 2, HPSG adopts the division of grammatical rules into *immediate dominance schemata* (ID) and *linear precedence rules* (LP), originally developed in GPSG (cf. Gazdar et al., 1985: 44ff), separating constraints on hierarchical relations from those constraints on linear word order.[50] Therefore, to account for a structure such as the one in Figure (2.8), HPSG employs on the one hand constraints describing the hierarchical relations on constituent structure – the ones we will deal with in this section – and on the other hand constraints licensing the linear position of these constituents (cf. Section 2.5.4).

ID-schemata[51] represent a small set of rules which constrain the possible hier-

[49] Pollard (2000: 6) discusses the problems of assuming lexical rules as unary branching trees with respect to the degree of specification of the input and how to relate it to its output.

[50] A framework – like GPSGand HPSG – whose grammatical system is defined as a pair consisting of a set of ID-schemata, and a set of LP-rules is in “Immediate Dominance/Linear Precedence format” (cf. Gazdar et al., 1985: 46). Thus, such grammatical systems are called ID/LP grammars.

[51] ID-schemata are also called *immediate dominance rules*, *grammar rules*, *phrase structure rules*, or $\overline{\mathrm{X}}$-*schemata* depending sometimes on the framework used, and sometimes on terminological

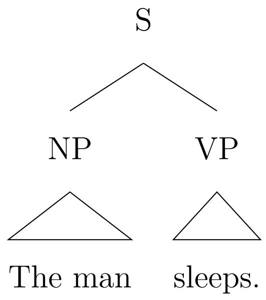

Figure 2.8: Phrase structure

archical structures of a language. One can think of them as the HPSG counterpart of the $\overline{\text{X}}$-schemata first introduced in Chomsky (1970) and further elaborated in Jackendoff (1977). Despite the similarities between ID-schemata and the $\overline{\text{X}}$-*schemata*, the set of axioms which made up the $\overline{\text{X}}$-*theory* are different from the structural assumptions made in HPSG.[52] For instance, HPSG does not assume the same structure for all phrasal types, nor the obligatory existence of a head for all phrases.[53] Nevertheless, Pollard and Sag (1994: 38) characterise the ID-schemata in HPSG as follows:[54]

> [. . .] a small, universally available set of disjunctive constraints on the immediate constituency of phrases, from among which each language makes a selection.

The number of ID-schemata must be kept small, and the disjunction of the single schemata is regarded as a universal principle, called *Immediate Dominance Prin-*

preferences. But keep in mind that $\overline{\text{X}}$-*schemata* contain not only information about dominance, but also about precedence.

[52]For a short description of the main assumptions of the $\overline{\text{X}}$-theory, see Fries and Machicao y Priemer (2016: 779–780).

[53]Not assuming heads in an axiomatic way eliminates the "head-driven" from the Head-Driven Phrase Structure Grammar, since the structure of some phrases are actually not driven by information contained in a head, see Footnote 63 for an example. Moreover, the notion of "phrase structure" also does not hold for HPSG (cf. Müller and Ørsnes, 2013: 5), since there are no independent phrase structure rules assumed in the grammar, in comparison to LFG or GPSG. See for a discussion on this matter (Müller, 2016a: 297ff).

[54]The (re)formulation of the $\overline{\text{X}}$-convention as it was conceived in the 1970s can be seen in Jackendoff (1977: 29ff). A later and more strict reformulation of the $\overline{\text{X}}$-theory with its respective motivation can be found in Kayne (1994).

ciple (IDP) which will be explained below. But before we approach the IDP, some details on the description of phrasal structures should be mentioned.

In comparison to the AVMs of lexical entries, but similar to the AVMs of lexical rules in DLR (cf. example (33)), descriptions (i.e. AVMs) of phrasal structures contain DAUGHTER (DTR) attributes. As almost always in phrase structure grammars we can distinguish two types of daughters. One constituent in the structure is meant to be the HEAD-DAUGHTER (HD-DTR), i.e. the constituent containing the head of the structure which determines most of the morphosyntactic properties of the whole structure. The other constituent represents the NON-HEAD-DAUGHTER (NH-DTR). Here, I am going to assume binary branching structures as is customary in the literature (cf. Speas 1990: 36; Haegeman 1994: 87–95; Müller (2016a: 535–538); a.o.), although not always favoured in HPSG (cf. Pollard and Sag, 1994: 38ff).[55] Therefore, the structure in Figure 2.8 receives the (abbreviated) description in (34) in which for presentation purposes all attribute-value pairs not relevant for the explanation have been omitted.

(34)
$$\begin{bmatrix} \text{PHON} & \left\langle \textit{the man sleeps} \right\rangle \\ \text{HD-DTR} & \begin{bmatrix}\text{PHON} & \left\langle \textit{sleeps}\right\rangle\end{bmatrix} \\ \text{NH-DTR} & \left\langle \begin{bmatrix}\text{PHON} & \left\langle\textit{the man}\right\rangle\end{bmatrix}\right\rangle \end{bmatrix}$$

Figure 2.8 and AVM (34) make almost the same statement with respect to the structural (in terms of: hierarchical) organisation: The whole phrase – i.e. (34) or S in Figure 2.8 – which has the (phonological) form *the man sleeps*, is constituted by:

- a head constituent with the phonological form *sleeps* (the VP in (2.8), or HD-DTR in (34)), and
- a non-head constituent with the phonological form *the man* (the NP in (2.8), or NH-DTR in (34)).[56]

[55] For a discussion on binary branching in general, see Müller (2016a: 535–538); and for binary branching in HPSG – in contrast to Pollard and Sag (1994) – see e.g. Müller (2013b) and Müller (2015b).

[56] Not assuming binary branching, but flat structures instead, there would be more than one sign element in the list value of NH-DTR as example (i) shows. The head *schenkt* 'gives' is

The values of the attributes HD-DTR and NH-DTR are of type *sign* and *list* of signs, respectively. Although, I'm working with binary branching structures here, it is nevertheless necessary to assume that NH-DTR has a value of type *list*, since there exist headless structures, which are a combination of two non-head daughters (see for instance the analysis of relative clauses in Müller 2013a: 185ff). The value *sign* is a supertype of *word* and *phrase*. Therefore, HD-DTR and NH-DTR can contain a structure of type *word* as a value – as is the case for HD-DTR in (34) – or a description of a more complex object, i.e. of type *phrase* – as is the case for NH-DTR in (34). Here, one advantage of the ID-schemata in HPSG in comparison to phrase structure rules in MGG becomes clear, namely that if a DTR can be of type *word* or *phrase*, there is no need for unary projections in order to concatenate objects as in Figure 2.9.[57]

The HPSG counterpart of Figure 2.9 is represented by the AVM (35). As can be seen, the system does not require unary projections, since the type underspecification for the daughter's value does the trick.

(35)
$$\begin{bmatrix} \textsc{phon} & \left\langle \textit{the man} \right\rangle \\ \textsc{hd-dtr} & \begin{bmatrix} \textsc{phon} \left\langle \textit{man} \right\rangle \end{bmatrix} \\ \textsc{nh-dtr} & \left\langle \begin{bmatrix} \textsc{phon} \left\langle \textit{the} \right\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

Unary projections can be considered as an artefact purely owed to the assumptions underlying the grammatical system, i.e. to the $\overline{\text{X}}$-*theory*, and not to language facts. One grammatical system can be regarded as more efficient, if it does not introduce

combined at once with the three non-head daughters *der Mann* 'the man.NOM', *dem Jungen* 'the boy.DAT', and *den Wagen* 'the car.ACC', yielding the phrase 'The man gives the boy the car' with a quaternary branching structure.

(i)
$$\begin{bmatrix} \textsc{phon} & \left\langle \textit{der Mann dem Jungen den Wagen schenkt} \right\rangle \\ \textsc{hd-dtr} & \begin{bmatrix} \textsc{phon} \left\langle \textit{schenkt} \right\rangle \end{bmatrix} \\ \textsc{nh-dtr} & \left\langle \begin{bmatrix} \textsc{phon} \left\langle \textit{der Mann} \right\rangle \end{bmatrix}, \begin{bmatrix} \textsc{phon} \left\langle \textit{dem Jungen} \right\rangle \end{bmatrix}, \begin{bmatrix} \textsc{phon} \left\langle \textit{den Wagen} \right\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

[57] It is not important in Figure 2.9 whether we assume a DP-analysis according to Abney (1987) or an NP-analysis, since the same problem occurs in both structures.

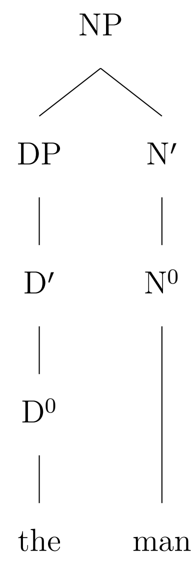

Figure 2.9: X-bar structure of NP

this kind of artefacts, or if it is able to get rid of them.[58]

Since the value of the NH-DTR attribute in the AVM (34) is of type *phrase*, and has an internal structure shown in the AVM (35), the complete binary structure of *The man sleeps* with respect to the head and non-head daughters can be described as in (36). This AVM can be regarded as parallel (but not equal!) to the $\overline{\text{X}}$-schemata; remember that the $\overline{\text{X}}$-schemata in narrow sense was conceived as part of a transformational grammar, and thus as part of a derivational theory, while HPSG is declarative. This difference is fundamental, since an $\overline{\text{X}}$-structure (in narrow sense) must be interpreted as a structure providing the whole derivational history of a phrase, and this does not hold for a description in HPSG. Therefore, the parallelism applies only to the structure, but not to the underlying theoretical assumptions (cf. Footnote 52 and the discussion of Figure 2.9).

[58] To be fair, new MGG-approaches like the so-called *bare phrase structure* in Minimalism (cf. Chomsky, 1995: 241ff) avoid unary projections, and a rigid distinction between the concept of head and phrase. See also Muysken (1982) for an older account based on parametrisation of the notion of head.

(36)
$$\begin{bmatrix} \textsc{phon} & \left\langle \textit{the man sleeps} \right\rangle \\ \textsc{hd-dtr} & \begin{bmatrix}\textsc{phon} & \left\langle \textit{sleeps}\right\rangle\end{bmatrix} \\ \textsc{nh-dtr} & \left\langle \begin{bmatrix} \textsc{phon} & \left\langle \textit{the man}\right\rangle \\ \textsc{hd-dtr} & \begin{bmatrix}\textsc{phon} & \left\langle\textit{man}\right\rangle\end{bmatrix} \\ \textsc{nh-dtr} & \left\langle \begin{bmatrix}\textsc{phon} & \left\langle \textit{the}\right\rangle\end{bmatrix}\right\rangle \end{bmatrix}\right\rangle \end{bmatrix}$$

Now, one further difference between the $\overline{\text{X}}$-schema and the representation of immediate dominance presented here so far concerns the codification of the relation between heads and non-heads. As pointed out at the beginning of this section, MGG approaches make use of tree-configurational notions in order to explain syntactic phenomena. The difference between heads, complements, adjuncts, and specifiers is hence encoded in the tree-configuration. I will not go into the details of how and on what grounds MGG encodes different syntactic functions, since several stages of the theory have given rise to different configurational systems and motivations (see for instance Chomsky 1970; Jackendoff 1977; Chomsky 1986; Speas 1990; Kayne 1994; Chomsky 1995; a.o.). But the distinction of these syntactic functions is of great relevance for explanations of syntactic phenomena. Figure 2.10 shows an $\overline{\text{X}}$-representation of the NP *der fantastische Gewinn der WM* 'the fantastic win of the World Championship' in a more or less classic fashion.[59] In a nutshell, the structure in Figure 2.10 encodes the following information, taking the $\overline{\text{X}}$-theory as its axiomatic ground:

- the N^0 [Gewinn] is a lexical element and the *head* of the whole phrase;
- the NP [der WM] is a *complement* of the head, thus it is its sister constituent, and it expands the N^0 category to N';
- the AP [fantastische] is an *adjunct*, thus it does not expand the projection from N' category to N'';

[59] The representation in Figure 2.10 can be regarded as a tree-configuration à la Haegeman (1994) without assuming a DP-hypothesis à la Abney (1987); see also Chomsky and Lasnik (1993: 527) for a description of the structure.

- the DP [der] is the *specifier*, thus it closes the projection from N′ to NP.

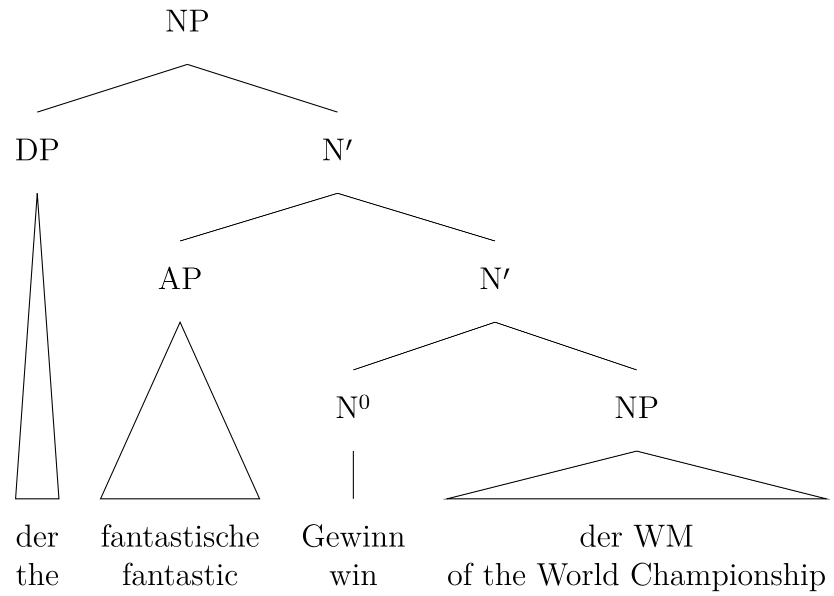

Figure 2.10: NP structure in X-bar (head, complement, adjunct, and specifier)

Since the number (i.e. the valency of the predicate) and the kind (i.e. the theta-roles assigned by the predicate) of complements is determined by the head, the head must provide the slots for their complements. In contrast to complements, adjuncts can be freely adjoined to structures, therefore they do not expand the projection, but double the intermediate projection X′.[60] The last position is reserved for specifiers, i.e. some kind of element that specifies the phrase, and of which there can be only one.[61] The relations *specifier-of* and *complement-of* are different in nature, since complements are "affected" in some sense by the head (e.g. by virtue of theta-role assignment), while the head is in some sense semantically "affected" by the specifier, but the specifier is syntactically required by the head (See Section 3 for a more detailed distinction between the notions of head, complement, specifier, and adjunct).

[60] This kind of adjunction is assumed in binary structures and is known under the name *Chomsky-adjunction*, although Chomsky denies to have something to do with it (cf. Jackendoff, 1977: 34).

[61] The notion of specifier, what does it mean for a linguistic object to be a specifier, and how many specifiers are structurally allowed are highly controversial topics. To mention a simple example, Speas (1990: 37) does not assume any limitation in the number of possible specifiers for lexical phrases, but only one specifier is allow in functional phrases. See Section 3.3 for a discussion of the specifier notion.

Now, since these different syntactic functions are relevant for a grammatical system, they must be reflected in ID-schemata. Not referring to tree-configurational notions, HPSG encodes these distinctions lexically in the different attributes (SUBJ, SPR, COMPS), and the constraints building the IDP restrict the way they concatenate with the head (cf. Pollard and Sag, 1994: 39f). The IDP, as mentioned above, is a small set of disjunctive constraints which give "[. . .] the universally available options for a well-formed phrase [. . .]" (Pollard and Sag, 1994: 38).[62] These constraints are reflected in the type hierarchy (cf. Figure 2.11). Linguistic objects, i.e. elements of type *sign*, are – as far as we have seen – of type *word* or *phrase*, phrases can be described as objects of type *non-headed-structure*[63] or *headed-structure*. Furthermore, the type *headed-structure* has the subtypes *head-subject-*, *head-complement-*, *head-specifier-*, and *head-adjunct-structure*, a.o.

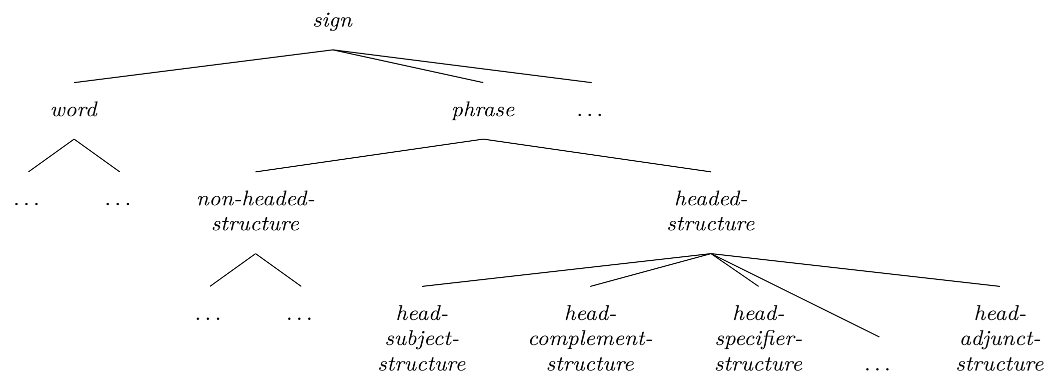

Figure 2.11: Type hierarchy of *sign* (preliminary)

Thus, for a phrase to be well-formed, it has to fulfil the requirements imposed by the constraints on the subtypes of *phrase*. The constraints imposed by the subtypes of *headed-structure* in Figure 2.11 restrict how heads can be combined with other elements; that is, they reflect the relations given by the $\overline{\mathrm{X}}$-representation in Figure 2.10. This will be exemplified by two ID-schemata:[64] the Head-Complement

[62]But see the comment on the IDP at the end of Section 2.5.5.

[63]As already mentioned, in HPSG the presence of a head in a structure is not regarded as axiomatically required. For instance, Pollard and Sag (1987: 147) consider the *coordinate-structure*, and Müller (2013a: 195) the *relative-clause-structure* as a subtype of *non-headed-structure*.

[64]Given the lexical basis of HPSG, the number of phrase structure rules, i.e. of ID-schemata, was reduced to six in Pollard and Sag (1994: 402f): Head-Subject Schema, Head-Complement

Schema in (37) and the Head-Specifier Schema in (38).[65]

But first some remarks on the notation of ID-schemata used here. ID-schemata are given in form of *implicational constraints* using the → operator (cf. Footnote 44). This operator has a different meaning from the one used in derivational approaches, where the arrow means 'substitution' (cf. the discussion of example (16)). Implicational constraints are read as implications; that means, that if a linguistic object satisfies the constraints on the left of the rule (or if it belongs to the type on the left), e.g. *head-complement-structure*, then this linguistic object must satisfy the description given on the right hand as well (cf. Kiss, 1995: 47ff).[66]

For the Head-Complement Schema in (37), that means that if a linguistic object is of type *head-complement-structure*, then the value of the NH-DTR's SYNSEM (i.e. $\boxed{2}$) is *structure-shared* with the value of one element of the HD-DTR's COMPS list. The value of the HD-DTR's COMPS is a list separated into two parts: $\boxed{1}$ and $\langle\boxed{2}\rangle$.[67] While $\boxed{2}$ is the element saturated by the NH-DTR, $\boxed{1}$ is the remaining list of unsaturated complements of the HD-DTR's COMPS list, and the COMPS list of the whole *head-complement-structure* is structure-shared with $\boxed{1}$, which could be the empty list if all complements are already saturated.

(37) ID-schema 1: Head-Complement Schema

$$\textit{head-complement-structure} \quad \rightarrow \begin{bmatrix} \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}|\text{COMPS}\ \boxed{1} \\ \text{HD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}|\text{COMPS}\ \boxed{1} \oplus \left\langle \boxed{2} \right\rangle \\ \text{NH-DTR}|\text{SYNSEM}\ \boxed{2} \end{bmatrix}$$

For the purpose of clarity, sometimes tree-diagrams are used (cf. Figure 2.12) instead of AVMs. In contrast to tree-diagrams in MGG, in HPSG they do not represent the derivational history of the structure, i.e. they do not represent the steps

Schema, Head-Subject-Complement Schema, Head-Marker Schema, Head-Adjunct Schema, and Head-Filler Schema. Compared to earlier phrase structural approaches, this reduction implies a significant simplification of the grammatical system (cf. Flickinger et al., 1985).

[65] Further ID-schemata will be explained in the remainder of this work. For different formulations of the ID-schemata, also with respect to the precision of the constraints given in them, compare Bildhauer (2014); Levine and Meurers (2006); Müller (2013a); and Pollard and Sag (1994).

[66] In simplistic descriptions of AVMs using the SUBCAT feature (cf. for instance Pollard and Sag 1994: 23) only a Head-Argument Schema is needed, since they do not separate the list of arguments into smaller parts (cf. Footnote 28 and the explanation of example (18)).

[67] Append (⊕) is a relational constraint which concatenates two lists. It will be explained in more detail in Section 2.5.6.

of derivation from a deep-structure to the surface-structure. Moreover, in HPSG they are only a visualisation of a declarative description such as the constraint in (37).

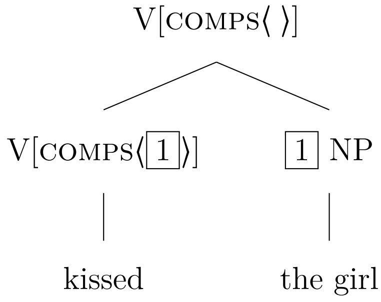

Figure 2.12: Head-complement structure

The Head-Specifier Schema in (38) licenses the combination of a head with a specifier. Since the specifier is an element needed by the head, it is to some extent "subcategorised" by the head, and therefore required by the attribute called SPR.

(38) ID-schema 2: Head-Specifier Schema

$$\textit{head-specifier-structure} \rightarrow \begin{bmatrix} \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}|\text{SPR}\ \boxed{1} \\ \text{HD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL} \begin{bmatrix} \text{SPR}\ \boxed{1} \oplus \left\langle \boxed{2} \right\rangle \\ \text{COMPS}\ \left\langle\ \right\rangle \end{bmatrix} \\ \text{NH-DTR}|\text{SYNSEM}\ \boxed{2} \end{bmatrix}$$

One reason to separate the valency list of specifiers[68] from the valency lists of further arguments, i.e. from SUBJ and COMPS, is given by the fact, that arguments of NPs and their determiners occupy different positions in the NP structure (cf. example (39)).[69] While a determiner occupies the left hand side of the noun (cf. *der* 'the'), the complement goes to its right (cf. *der WM* 'of the World Championship').

(39) *der* Gewinn *der* *WM*
the.NOM win the.GEN World Championship
'the win of the World Championship'

[68]The SUBJ and the SPR lists are analysed as singletons, in comparison to the COMPS list, since constituents can have normally only one subject or a specifier, but more than one complement (cf. Pollard and Sag 1994: 348, Przepiórkowski 1999: 18f).

[69]A similar reasoning yields the division of SUBCAT into SUBJ and COMPS, see for instance Pollard and Sag (1994: 362). For the distinction of SUBJ and SPR, see Pollard and Sag (1994: 359ff).

In order to account for the correct linearisation, LP-rules are needed. But treating specifiers and complements as elements of the same SUBCAT list, would lead to ungrammatical structures like (40) in case that an LP-rule requires all elements of SUBCAT to be to the left, or all to be to the right of the head (cf. Müller, 2013a: 135f). A similar motivation for specifiers can be found in the early transformational foundations of $\overline{\text{X}}$-theory in Chomsky (1970: 210f).

(40)	* Gewinn	*der*	*der*	*WM*
	win	the.NOM	the.GEN	World Championship

Moreover, a specifier has to be combined with its head (or with the phrase projected by its head) as the last element. That is to say, the COMPS list of the HD-DTR must be empty, before the phrase can be combined with the specifier. The constraint in (38) reflects this fact stating that the COMPS list of the HD-DTR has no elements. Without this restriction, two possible structures, cf. Figures 2.13 vs. 2.14, are licensed yielding a spurious structural ambiguity (cf. Müller, 2013a: 136).

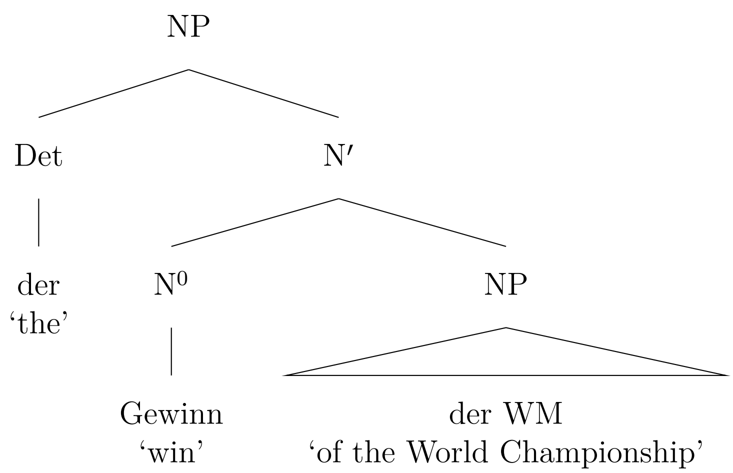

Figure 2.13: Head-specifier – Structure 1

A further argument against the equal treatment of arguments and specifiers concerns the fact that only a small class of elements can serve as specifiers (cf. Jackendoff, 1977: 103ff), e.g. determiners for NPs.[70] Moreover, their relation to the head is different from the one between complement and head, in a nutshell: While specifiers normally restrict the meaning of the head, complements are normally

[70]For VPs, Chomsky (1970: 210ff) assumes auxiliary verbs to be their specifiers. Later, subjects (or 'subject-like elements') were analysed as specifiers of VP (cf. Chomsky, 1986).

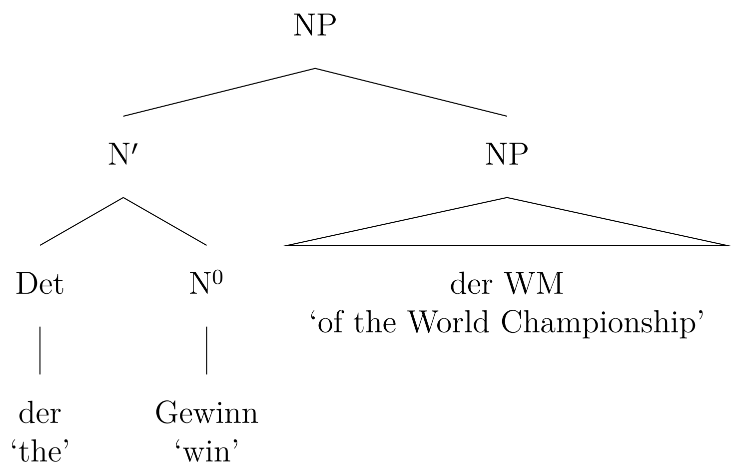

Figure 2.14: Head-specifier – Structure 2

affected by the head, e.g. by means of theta-roles. This is reflected in HPSG by a mutual selection between specifier and head. While the head selects the specifier through the SPR feature, the specifier selects the head through its SPECIFIED (SPEC) feature (cf. Pollard and Sag, 1994: 363).

Taking the short explanation of ID-schemata, one further advantage of HPSG in contrast to earlier transfomational approaches comes up. To say it in the words of Pollard and Sag (1987: 191): “the lexicalization of linguistic information leads to a drastic reduction in the number and complexity of phrase structure (ID) rules”. For instance, the subcategorisation of arguments in such approaches must be encoded twice: Firstly in the lexicon, because different verbs show different subcategorisation patterns (e.g. *helfen* ‘help’ with NOM and DAT vs. *unterstützen* ‘support’ with NOM and ACC); secondly in the syntax, since different kinds of arguments occupy distinct positions in the syntactic structure. Conversely, for the distinction between subject, complement, and specifier HPSG only needs the specification in the lexicon, since it makes no use of tree-configurational explanations, but only of a declarative system. Furthermore, the mapping between semantic (e.g. theta-roles) and syntactic (e.g. case assignment) information can be solved lexically, and there is no need to seek for answers in two different subsystems.[71]

[71] There are some attempts to get rid of the double encoding in MGG, normally in favour of the syntactic structure, and not of the lexical encoding, see for example Kratzer (1996).

2.5.4 Linear precedence rules

The ID-schemata presented in the previous section determines only the hierarchical relations between objects. In order to constrain the possible positions of constituents, HPSG (as well as GPSG Gazdar et al. cf. 1985: 44ff) makes use of LP-rules. The example (41) shows the 6 possible configurations for the specifier *der*, the head-noun *Gewinn*, and its complement phrase *der WM*, of which only (41a) is grammatical.

(41) a. [der]$_{\text{SPEC}}$ Gewinn [der WM]$_{\text{COMP}}$
the win of the World Championship

b. * [der WM]$_{\text{COMP}}$ Gewinn [der]$_{\text{SPEC}}$
of the World Championship win the

c. * Gewinn [der]$_{\text{SPEC}}$ [der WM]$_{\text{COMP}}$
win the of the World Championship

d. * Gewinn [der WM]$_{\text{COMP}}$ [der]$_{\text{SPEC}}$
win of the World Championship the

e. * [der]$_{\text{SPEC}}$ [der WM]$_{\text{COMP}}$ Gewinn
the of the World Championship win

f. * [der WM]$_{\text{COMP}}$ [der]$_{\text{SPEC}}$ Gewinn
of the World Championship the win

Due to the binarity constraint, stated in the ID-schemata, and the Head-Specifier Schema, which states that a specifier can only adjoin to a head with an empty COMPS list, the structures in (41c) and (41f) are ruled out, but (41b), (41d), and (41e) are still not being ruled out by the grammatical system, despite their ungramaticality. LP-rules constraining the order of constituents inside phrases help to get the right results in these cases. With LP-rules (cf. Pollard and Sag, 1987: 169ff), it is possible to constrain the order of:

- elements which contain a certain feature-configuration, or
- elements with a certain syntactic function, e.g. specifier or argument, (cf. (43)), or
- elements with a certain feature-configuration fulfilling a certain syntactic function (cf. (42)).

ID/LP grammars have an advantage towards a strong universal interpretation of the $\overline{\text{X}}$-schema (cf. Kayne, 1994: 33ff). It is more natural to posit universal rules to constrain hierarchical relations between words and phrases (our ID-schemata), but if these hierarchical constraints have to adjust constituent order as well, they actually loose their universal potential, since – typologically seen – linear order is much more variable than hierarchical relations. Therefore, a universal $\overline{\mathrm{X}}$-schema, which reflects also matters of constituent order, must assume a movement mechanism to achieve the distinct linearity patterns existent in the world languages, making the grammatical system of some languages unnecessarily complex.[72] Whereas, our ID/LP grammar can postulate universals with respect to structural hierarchy, and let linear order be generalised by means of LP-rules avoiding a mechanism such as movement. Furthermore, universals on constituent order can be as well postulated without being forced – but with the possibility – to make claims about hierarchical structure (cf. Gazdar et al., 1985: 49f), so for example for the so-called "Greenberg universals" (cf. Greenberg, 1963: 58ff).

Going back to our phrases in (41), inserting a new attribute INITIAL (INI), whose values are + or −,[73] as a head attribute the position of arguments with respect to its head can be modelled either with the LP-rule in (42a) if the head precedes the argument, or with (42b) if the arguments precede the head (cf. Müller 1999: 163ff and Müller 2013a: 132f). This new attribute is needed, since German NPs are head-initial, but its VPs are head-final. Hence, one cannot make a generalisation with only one rule for all heads in German, but generalisations for heads with the value INI+ or INI−, respectively.[74]

(42) LP-rule 1: Head – Argument
   a. head[INI+] < argument
   b. argument < head[INI−]

In the case of (41), the rule in (42a) would apply, ruling out all NPs in which the complement phrase precedes the head noun, that is (41b), (41e), and (41f).

[72] See for instance the derivational complexity for some possible constituent orders within NPs in Cinque (2005) and Georgi and Müller (2010). This complexity is due to the assumption of a rigid universal pattern "Specifier-Head-Complement" à la Kayne (1994). It is controversial, whether the derivational complexity is reflected in some way in cognitive complexity – and until now, there is no psycholinguistic evidence for that – or whether it should only be regarded as an artefact created by the axioms of the theory.

[73] To be more precise, the value of INI is of type *boolean* (*bool*), which has two subtypes + and −.

[74] In contrast to pure head-initial languages like English, or pure head-final languages like Japanese (cf. Pollard and Sag, 1987: 172).

Similarly, in order to rule out phrases in which the head precedes the specifier (cf. (41b), (41c), and (41d)), an LP-rule that refers to this head-specifier relation, such as (43), is needed.

(43) LP-rule 2: Head – Specifier
specifier < head

As a result, the LP-rules in (42) and (43), along with the ID-schemata Head-Complement Schema given in (37) and Head-Specifier Schema given in (38) would yield grammatical structures licensed by constraints such as (44), (45), and (46).

(44) Head < Argument

$$\begin{bmatrix} \textsc{phon}\ \boxed{3} \oplus \boxed{4} \\ \textsc{synsem}|\textsc{loc}|\textsc{cat}|\textsc{val}|\textsc{comps}\ \boxed{1} \\ \textsc{hd-dtr}\ \begin{bmatrix} \textsc{phon}\ \boxed{3} \\ \textsc{synsem}|\textsc{loc}|\textsc{cat}\ \begin{bmatrix} \textsc{head}|\textsc{ini}\ + \\ \textsc{val}|\textsc{comps}\ \boxed{1} \oplus \left\langle \boxed{2} \right\rangle \end{bmatrix} \end{bmatrix} \\ \textsc{nh-dtr}\ \begin{bmatrix} \textsc{phon}\ \boxed{4} \\ \textsc{synsem}\ \boxed{2} \end{bmatrix} \end{bmatrix}$$

Since in (44) the value of the INI attribute of the HD-DTR is +, the PHON value of the whole structure is computed by the concatenation of the HD-DTR's PHON value first, and the NH-DTR's PHON value next. This is the case of our only grammatical example (41a) with respect to the head-complement combination.

(45) Argument < Head

$$\begin{bmatrix} \textsc{phon}\ \boxed{4} \oplus \boxed{3} \\ \textsc{synsem}|\textsc{loc}|\textsc{cat}|\textsc{val}|\textsc{comps}\ \boxed{1} \\ \textsc{hd-dtr}\ \begin{bmatrix} \textsc{phon}\ \boxed{3} \\ \textsc{synsem}|\textsc{loc}|\textsc{cat}\ \begin{bmatrix} \textsc{head}|\textsc{ini}\ - \\ \textsc{val}|\textsc{comps}\ \boxed{1} \oplus \left\langle \boxed{2} \right\rangle \end{bmatrix} \end{bmatrix} \\ \textsc{nh-dtr}\ \begin{bmatrix} \textsc{phon}\ \boxed{4} \\ \textsc{synsem}\ \boxed{2} \end{bmatrix} \end{bmatrix}$$

In (45), the PHON value of the whole structure is the other way around: the NH-DTR's PHON value, followed by the HD-DTR's PHON value. This is needed in

German for the combination of verbs with their arguments. Being German a verb-final language, nouns and verbs must encode different INI values, + for the former, and − for the latter.

(46) Specifier < Head

$$\begin{bmatrix} \text{PHON} & \boxed{4} \oplus \boxed{3} \\ \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}|\text{SPR} & \boxed{1} \\ \text{HD-DTR} & \begin{bmatrix} \text{PHON} & \boxed{3} \\ \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL} & \begin{bmatrix} \text{SPR} & \boxed{1} \oplus \left\langle \boxed{2} \right\rangle \\ \text{COMPS} & \left\langle\ \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{NH-DTR} & \begin{bmatrix} \text{PHON} & \boxed{4} \\ \text{SYNSEM} & \boxed{2} \end{bmatrix} \end{bmatrix}$$

In (46), the INI values are not relevant. The LP-rule constraining the linearity of the head and its specifier only refers to the syntactic categories, and not to internal attribute-value pairs of them. The result is the concatenation of the specifier, i.e. of the NH-DTR's PHON value, with the head, i.e. the HD-DTR's PHON value. Furthermore, the ID-schema in (38) specifies that the HD-DTR's COMPS list must be empty in order for the two elements to be concatenated.

Finally, the interplay of ID-schemata and LP-rules give as the only possible grammatical structure the one in (41a), as it was intended to be.

2.5.5 Grammatical principles

Some generalisations must be regarded as having a broader coverage than others. In this respect, we could say that lexical entries – as treated in Section 2.5.1 – are the most idiosyncratic elements in our system, while some LP-rules (cf. Section 2.5.4) are to a great extent a matter of language specific (or language-family specific) constraints. Besides this, there are some other regularities that seem to be almost universal in nature. One of these regularities concerns the relation of a head and its phrase in endocentric structures, that is of a N^0 and its NP, or of a V^0 and its VP. In derivational approaches this is provided by $\overline{\text{X}}$-theory and the so-called Projection Principle (cf. Chomsky 1981: 29ff, Chomsky 1995: 51f). In HPSG, this relation is guaranteed not only by the *Head Feature Principle* (HFP), but also by the *Valence Principle* (ValP).[75]

The HFP ensures that a part of the information of an AVM in a phrase of type *headed-structure* or in its subtypes (cf. Figure 2.11) is shared between the mother and the HD-DTR. According to Pollard and Sag (1994: 34), the HFP is formulated as (47).

(47) Head Feature Principle (HFP)
The HEAD value of any headed phrase is structure-shared with the HEAD value of the head daughter.

The HFP can also be formulated in form of an implicational constraint applying only to elements of type *headed-structure* (and by virtue of inheritance on its subtypes too), as shown in (48).

(48) Head Feature Principle (HFP)

$$\textit{headed-structure} \quad \rightarrow \quad \begin{bmatrix} \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{HEAD } \boxed{1} \\ \text{HD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{HEAD } \boxed{1} \end{bmatrix}$$

The attributes contained in HEAD, as far as we have seen, say something about the part of speech, for verbs about the verb form (cf. (19)), and for nouns about the case (cf. (20)), in addition, the head attribute INI says something about the position of the head in relation to its arguments. All this information is important for the whole phrase and must be visible for the element which takes the phrase as an argument. Let us exemplify this fact by the phrase in Figure 2.13, here repeated as 2.15 and expanded by the needed features.

First, we have here a concatenation of two NPs: NP_{ii} with its head *Gewinn* 'win', and NP_i with its head *WM* 'World Championship'. The head attribute of NP_i has a value of type *noun*, containing information about CASE *genitive* (*gen*), and INI +. The combination of the head noun with the determiner is licensed by means of the Head-Specifier Schema, and since the type *head-specifier-structure* is a subtype of *headed-structure* the HFP holds. Therefore, the HEAD value of the head noun $N^0{}_i$ and the HEAD value of NP_i is structure-shared, i.e. identical.

[75] The Head Feature Principle can be regarded as a reformulation of the *Head Feature Convention* (HFC) from GPSG (cf. Gazdar et al., 1985: 50f), and the Valence Principle (cf. Pollard and Sag, 1994: 348) is a reformulation of the *Subcategorisation Principle* (from Pollard and Sag, 1987: 11, 71) which has its roots in the *argument cancellation* of CG (cf. Pollard and Sag, 1987: 10f).

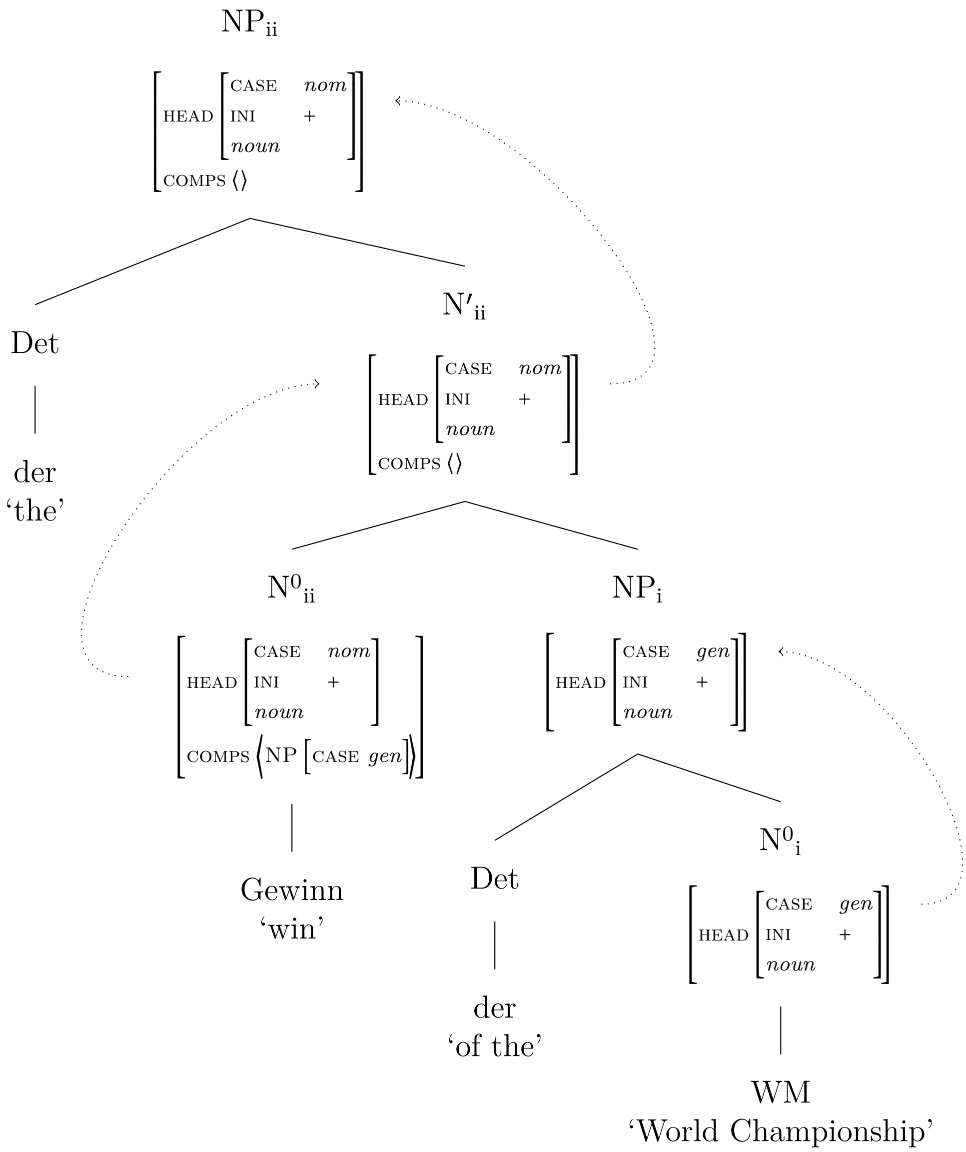

Figure 2.15: Illustration of Head Feature Principle

Second, since the $N^0{}_{ii}$ and NP_i are concatenated by virtue of the Head-Complement Schema – with $N^0{}_{ii}$ being the head, and NP_i being the argument – the head attributes of NP_i must be visible. Namely, $N^0{}_{ii}$ is looking for a noun phrase in genitive case (cf. COMPS list of $N^0{}_{ii}$). In addition, the HEAD value of $N^0{}_{ii}$ is projected to (or more accurately *structure-shared* with) the further tree nodes (cf. N'_{ii} and NP_{ii}) by virtue of HFP.

The second principle mentioned above – the ValP – describes the way to satisfy the arguments of a head and how the list of not-satisfied arguments is passed on to the next projection. In order to satisfy this principle – in comparison to the Subcategorisation Principle (SUBCATP) formulated by Pollard and Sag (1987: 71) – three different lists must be considered: SUBJ, COMPS, and SPR (cf. Pollard and Sag, 1994: 348). The SUBCATP, conversely, considers only one list, the SUBCAT list, which concentrates all arguments of the previous mentioned lists.[76]

According to Pollard and Sag (1994: 348), the ValP can be formulated as follows:

(49) Valence Principle (ValP)
In a headed phrase, for each valence feature F, the F value of the head daughter is the concatenation of the phrase's F value with the list of SYNSEM values of the F-DTRS values.

Valence features (F) are SUBJ, COMPS, and SPR. This formulation implies the following for objects of type *headed-structure*:

1. if we are dealing with the combination of a head with its *subject*, then the value of the valence feature SUBJ of the mother will be the same as the value of the valence feature SUBJ of the HD-DTR minus the value of the SYNSEM of the NH-DTR (i.e. the saturated argument); and

[76] As far as all arguments are kept into one single list, i.e. the SUBCAT list, the SUBCATP in contrast to the ValP is formulated by Pollard and Sag (1994: 34) as follows:

(i) Subcategorisation Principle (SUBCATP):
In a headed phrase (i.e. a phrasal sign whose DTRS value is of sort *head-struc* [*headed-structure*; MyP]), the SUBCAT value of the head daughter is the concatenation of the phrase's SUBCAT list with the list (in order of increasing obliqueness) of SYNSEM values of the complement daughters.

2. if we are dealing with the combination of a head with one of its *complements*, then the value of the valence feature COMPS of the mother will be the same as the value of the valence feature COMPS of the HD-DTR minus the value of the SYNSEM of the NH-DTR (i.e. the saturated argument); and

3. if we are dealing with the combination of a head with its *specifier*, then the value of the valence feature SPR of the mother will be the same as the value of the valence feature SPR of the HD-DTR minus the value of the SYNSEM of the NH-DTR (i.e. the saturated specifier); but

4. if we are dealing with the combination of a head with a *non-argument*, then the value of the valence features SUBJ, COMPS, and SPR of the mother will be the same as the respective values of the valence feature of the HD-DTR.

Taking our ID-schemata and our preliminary type hierarchy for *sign* (cf. Figure 2.11) from Section 2.5.3, a formalisation of the ValP needs a disjunctive constraint expressed using the logical disjunction ∨, describing what happens with the valence features for each subtype of *headed-structure* (cf. for a similar reasoning Przepiórkowski 1999: 20).[77] The formalisation can be given as shown in (50).

Another Principle which has already been referred to in Section 2.5.3 is the *Immediate Dominance Principle* (IDP). The IDP was thought to be the HPSG counterpart of $\overline{\text{X}}$-theory. That is to say, the IDP constitutes "[…] the 'phrase structure rule' component of HPSG […]" (Przepiórkowski, 1999: 20). It consists – similar to the ValP – of constraints which are disjunctively combined. The single disjuncts of the principle are the ID-schemata, which constraint possible ways of immediate constituency of phrases.[78] Thus, in Pollard and Sag (1994: 38), the IDP is assumed to be a universal principle constraining phrase structures from which every language makes a selection of the needed ID-schemata. Some of the ID-schemata have been already shown in Section 2.5.3. The IDP formulated by Pollard and Sag (1994: 399)[79] considers only phrases of type *headed-structure*, but

[77] Sag (1997: 439f) offers a shorter formalisation of the ValP by means of defaults. I have chosen here a more specific formalisation, since defaults have not been introduced here.

[78] In Pollard and Sag (1987: 147ff), ID-schemata are called grammar rules.

[79] For a formalised version of the IDP of Pollard and Sag, see Richter (2000: 432f). The IDP is formulated by Pollard and Sag (1994: 399) as follows:

(i) Immediate Dominance Principle (IDP): Every headed phrase must satisfy exactly one of the ID schemata.

(50) Valence Principle (ValP)

$$
\textit{headed-structure} \rightarrow
\begin{bmatrix}
\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}|\text{SUBJ}\ \boxed{1} \\
\text{HD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}|\text{SUBJ}\ \boxed{1} \oplus \left\langle \boxed{2} \right\rangle \\
\text{NH-DTR}|\text{SYNSEM}\ \boxed{2} \\
\textit{head-subject-structure}
\end{bmatrix}
\vee
\begin{bmatrix}
\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}|\text{COMPS}\ \boxed{1} \\
\text{HD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}|\text{COMPS}\ \boxed{1} \oplus \left\langle \boxed{2} \right\rangle \\
\text{NH-DTR}|\text{SYNSEM}\ \boxed{2} \\
\textit{head-complement-structure}
\end{bmatrix}
\vee
\begin{bmatrix}
\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}|\text{SPR}\ \boxed{1} \\
\text{HD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}|\text{SPR}\ \boxed{1} \oplus \left\langle \boxed{2} \right\rangle \\
\text{NH-DTR}|\text{SYNSEM}\ \boxed{2} \\
\textit{head-specifier-structure}
\end{bmatrix}
\vee
\begin{bmatrix}
\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}\ \boxed{1} \\
\text{HD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}\ \boxed{1} \\
\text{NH-DTR}|\text{SYNSEM}\ \boxed{2} \\
\textit{head-adjunct-structure}
\end{bmatrix}
$$

as mentioned in Footnote 63 also phrases of type *non-headed-structure* are assumed in the literature. Based on Przepiórkowski (1999: 20), I am assuming here that the IDP must be a principle for the type *phrase* and not only for the type *headed-structure*, and be formalised as in (51).

(51) Immediate Dominance Principle (IDP)

$$\textit{phrase} \rightarrow \begin{array}{l} \text{ID-schema 1} \\ \vee \\ \text{ID-schema 2} \\ \vee \\ \text{ID-schema 3} \\ \vee \\ \ldots \end{array}$$

The restriction given by the IDP is actually very weak and almost trivial since it lists all schemata which are founded in possible languages only reflecting what a cross-linguistic type hierarchy would say. Originally, the IDP was thought as a phrase structural component consisting of few schemata, e.g. the six schemata listed in Footnote 64 (cf. Pollard and Sag, 1994: 38), but given the structural complexity of languages – regarded cross-linguistically – the accuracy of such a principle has been challenged.

2.5.6 Relational constraints

In addition to the constraints shown in the past sections, some relational symbols or functions have been introduced in the literature in order to extend the expressive power of the theory. Pollard and Sag (1994: 21) introduce first the "functional or relational symbols": *append* ($\oplus$), *union* ($\cup$) and $\neq$, which they consider "necessary in a linguistically adequate description language". Relational constraints are defined in the signature of the grammar, in order to be available as part of the descriptive language. The mathematical foundations of such constraints and their status as part of the descriptive language is given in King (1999) and extended by Richter (2000). The concept of relational constraint will be explained in the following using *append*.[80]

[80] For more details on relational constraints, see King (1999) and Richter (2000).

The append symbol (⊕) has already been used in former constraints, so for example in the formalisation of the ValP (50) in Section 2.5.5. There, append was used to express the concatenation of two lists. This may sound in some way "derivationally", but it isn't (cf. Richter, 2000: 135f). The *concatenation* of lists as presented in the former constraints is only a short cut for a constraint which *relates* three lists as in (52). The example in (52) is well formed if and only if, $\boxed{3}$ has the same value as the concatenation of $\boxed{1}$ and $\boxed{2}$, whereby $\boxed{1}$, $\boxed{2}$, and $\boxed{3}$ are all objects of type *list*.

(52) append($\boxed{1}$, $\boxed{2}$, $\boxed{3}$)

This is by no means a derivational, but a declarative statement which can be represented as well as an AVM (cf. 53).[81] Here, the value of the attribute A is the concatenation of the values of B and C, therefore the value of A is *relational*, viz. it has no absolute value, but depends on the values of the other two attributes (cf. Kiss, 1995: 51).

(53) $\begin{bmatrix} \text{A} & \boxed{1} \oplus \boxed{2} \\ \text{B} & \boxed{1} \\ \text{C} & \boxed{2} \end{bmatrix}$

Append has been used in the former constraints exactly in this sense: as a short cut for the declarative relation in (52), and yielding to some extent a "dynamic extension" of the structure-sharing concept (cf. Kiss, 1995: 51).

[81] For further notational variants of *append*, see e.g. Bildhauer (2014: 532).

3 Basic notions of syntactic structure

In this chapter the four central notions in linguistic theory *head*, *argument*, *adjunct*, and *specifier* will be described, distinguished, and exemplified by focusing how they apply to NPs. These four notions are based on the idea that different kinds of relationships can hold between linguistic objects, that is to say by ascribing a linguistic object one of these notions, the relation in which it stands to another linguistic object is indicated. The possible configurations of relations are illustrated in Figures 3.1–3.4.

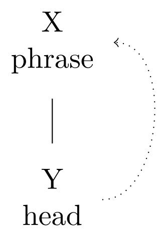

Figure 3.1: Head-phrase relation

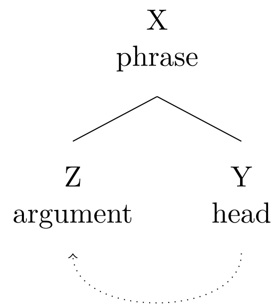

Figure 3.2: Head-argument relation

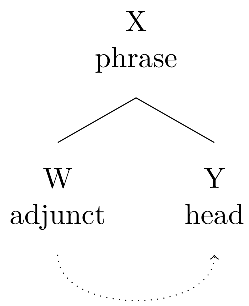

Figure 3.3: Head-adjunct relation

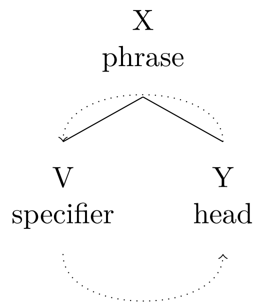

Figure 3.4: Head-specifier relation

It will be shown, that the notion of headedness differs from the other notions in that it represents a "vertical relation" between the "core" of a structure and the structure itself (Y and X respectively in Figure 3.1). In the head-phrase relation the element identified as the head determines main properties of the phrase. On the other hand, the notions of argument, adjunct, and specifier represent "horizontal relations" between the head and other constituents of the structure (Y and Z, W, or V in Figures 3.2–3.4 respectively).

Moreover, it will be presented by which diagnostics the different dependencies between constituents can be determined. For instance, while the head selects its arguments and determines their properties, adjuncts select the properties of the head with which it can be combined, and with respect to specifiers, there is a mutual specifier-head selection.

Besides the descriptive explanation of the differences between the relations, HPSG analyses of the different relations will be given to display the advantage of a framework which incorporates all levels of linguistic description at once, since semantics as well as syntax are relevant to highlight the differences between arguments, adjuncts, and specifiers.

3.1 Head

The notion of *head* is central throughout morphosyntactic theories, and with no doubt also for a theoretical framework which bears the attribute *head-driven* in its name (cf. Pollard and Sag, 1987: 6).[1] In the combination of words (or affixes and stems in morphology) in endocentric structures, there is one element determining the relevant properties of the combination's product (cf. Bloomfield, 1933: 194ff). This element, which determines the properties of the whole structure, is named the *head* of the structure (cf. Zwicky, 1985; Fries and Machicao y Priemer, 2016b; Machicao y Priemer, 2018b).

In this section, the notion of headedness as a vertical relation between a word and a phrase (or a morpheme and a word) as illustrated in Figure 3.5 will be motivated. In the following Sections 3.2 and 3.3, the notion of head will be examined with respect to other elements with which it builds a phrase (cf. Machicao y Priemer, 2018c).

[1] But remember that HPSG is not axiomatically considered as head-driven anymore as mentioned in Footnote 53.

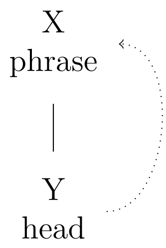

Figure 3.5: Head-phrase relation

The definition of the headedness relation in a particular case is dependent on the properties which are projected from the head to the phrase.[2] For instance, an element which can be considered a *semantic* head, does not need to coincide with the *syntactic* head of the same structure (cf. Ackema 2015 and Section 3.2.3 for a brief discussion of this). Here, I am going to focus on syntactic heads, and point out semantic aspects whenever they are needed.

For instance, in the following examples (1a) and (1b) *Gewinn* 'win' is considered the head of the whole structure.

(1) a. Gewinn der WM
win the.F.SG.GEN World Championship.F.SG.GEN
'win of the World Championship'

b. fantastischer Gewinn
fantastic.M.SG.NOM win.M.SG.NOM
'fantastic win'

As shown in Figure 2.10 in Section 2.5.3, here repeated as Figure 3.6, the head N^0 *Gewinn* projects its properties (through its projection line N^0–N′–N′–NP) to the whole phrase NP. All other phrases (i.e. the DP, AP, and the complement NP) are dependents of the head. As pointed out by Hudson (2004: 8), dependency and headedness are "[...] clearly very closely related" notions, nevertheless both can and should be separated. While *headedness* is the vertical relation along the projection line between the head N^0 and its phrase NP in Figure 3.6, *dependency* is the horizontal relation between the head and the elements that are connected to its projection line, whereby the head determines the properties of the whole structure. As a consequence, the whole structure is an NP and not, for instance, a DP or an

[2]For a discussion, see for instance Payne and Huddleston (2002: 330) and Hudson (2004).

AP).[3]

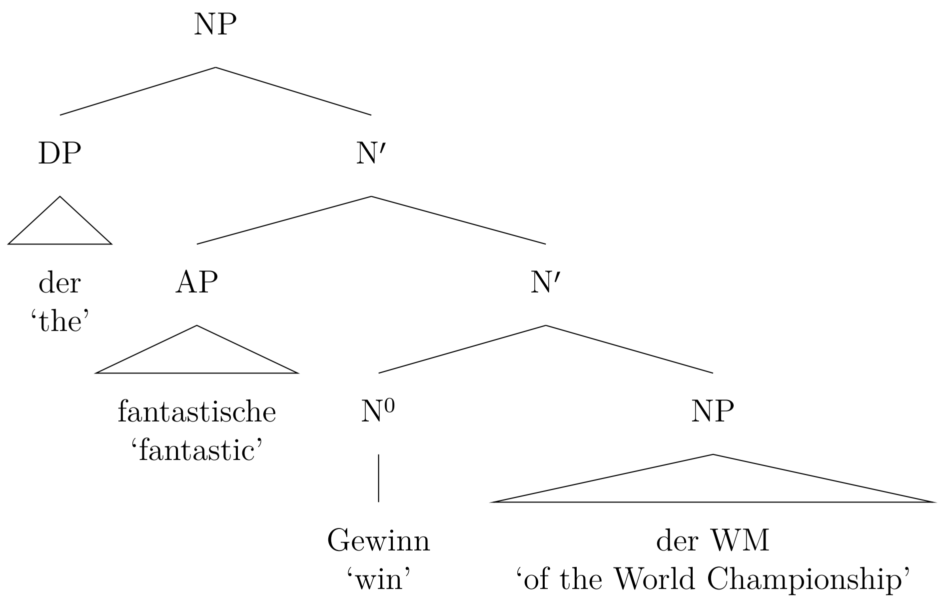

Figure 3.6: NP structure in X-bar-theory

Now, the relevant properties determined by the head can be divided into four main aspects (cf. Adger 2004: 62–90; Müller 2013a: 10–11; Machicao y Priemer 2018b; a.o.):

1. the organisation of the phrasal structure,
2. the word class and further morphosyntactic features,
3. the distributional potential of the phrase, and
4. the interpretation of the phrase.

In the following Sections 3.1.1–3.1.5, these four main properties of heads will be exemplified.

[3]That it is a *horizontal relation* is more clear in the notion of head given by Payne and Huddleston (2002: 330). They assume a definition of *head* which is relational to the structure built. For instance, N^0 is the head related to the N′ *Gewinn der WM*; but N′ *Gewinn der WM* is the head related to the N′ *fantastische Gewinn der WM*, and so on. N^0 is in this case called the *ultimate head*. This notion of head is analogue to the syntactic notion of *head-daughter* in HPSG.

3.1.1 Organisation of the phrase structure (ad 1)

The organisation of the phrasal structure is determined by the head since it is the head which determines *where*, *which* and *how many elements* are needed to form a grammatical structure.

In an HPSG formalisation, which and how many elements are needed, is encoded in the valence features (or VAL) of the head constituent, i.e. in SUBJ, COMPS, and SPR. In Figure 3.6, the head – more precisely: the AVM of the head – determines that the phrases [$_{\mathrm{DP}}$ *der*] and [$_{\mathrm{NP}}$ *der WM*] can only be licensed as elements of the SPR and COMPS lists, respectively,[4] with both phrases being dependents of the head. Since the head does not subcategorise for an AP, the phrase [$_{\mathrm{AP}}$*fantastische*] is not *required by* the head, but it is nevertheless a *dependent of* it, too. This becomes evident for two reasons: Firstly, the AP is – in this case pre-nominal – which is determined by the kind of phrase the head forms (i.e. NP). Secondly, the adjective agrees with the head in case, number, and gender, and which features are relevant for agreement depend on the category of the head.

The question where dependents of the head can be situated inside the head's phrase – more precisely, which linear positions the phrases attached to the projections of the head (i.e. DP, AP and NP) can take – is a matter solved by the ID-schemata and by the LP-rules (cf. Sections 2.5.3 and 2.5.4, especially the solution of example (41)).

3.1.2 Word class and morphosyntactic features (ad 2)

Depending on the word class of the head different morphosyntactic properties are passed over – or *projected*[5] – to the phrase it forms. For instance, head *nouns* project case, person, number, and gender features, such that if the head – i.e. N^0 – has the attribute-value pairs CASE: *nom*, PER: *3*, NUM: *sg*, GEND: *masc*, then the whole phrase shares these features too; but head *verbs* project another set of features. Verbs do not project case or gender, but they do project the verb form they have, i.e. the value of their VFORM attribute, e.g. *finite* (*fin*) or *infinitive* (*inf*),

[4]The phrase [$_{\mathrm{NP}}$ *der WM*] is not an obligatory complement of the head noun, since nouns (normally) do not have obligatory complements, in comparison to verbs. This point will be discussed in more detail in Section 4.5. Nevertheless the NP [*der WM*] is an argument of the head. How arguments are constrained will be shown in Section 3.2.

[5]Remember that projection of features in HPSG is solved by means of *structure sharing*.

as was mentioned in Section 2.4.

Here, a brief distinction is needed, namely with respect to the difference between the "head of a structure" and the "HEAD attribute" in an AVM. Every lexical and phrasal sign – that is, loosely speaking every word or every phrase – has a HEAD attribute which contains *some* of the relevant features to be projected to its phrase. But not every lexical or phrasal sign is the head of a structure. Taking for instance the Figure 2.15 from Section 2.5.5, repeated here as Figure 3.7, it becomes clear that:[6]

- N^0_{ii} [*Gewinn*] is the structural head of the whole phrase (i.e. NP_{ii});
- N^0_i [*WM*] is the structural head of the phrase NP_i, which in turn is a dependent of N^0_{ii};
- the HEAD features of every head (N^0_{ii} and N^0_i) are projected to their correspondent phrases (NP_{ii} and NP_i, respectively), due to the HFP (cf. Section 2.5.5); and
- NP_i [*der WM*] is the complement of N^0_{ii}, since NP_i satisfies the constraints imposed by the COMPS feature of N^0_{ii} and by the *head-complement-structure* (cf. Section 2.5.3).

That is, the structural head is represented in an AVM as the *sign* value of a HD-DTR attribute. That means, the question if one element is the 'head' of a structure depends on the constraint licensing the structure (e.g. *head-complement-structure*). On the other hand, every sign has a HEAD attribute, with the relevant morphosyntactic properties of the sign that have to be projected.

As it was mentioned in the discussion of the HFP, depending on the category of the head, different values are projected. But the values of GEND, NUM, and PER for nouns were not among these values. How they are passed on from the structural head to the phrase without being HEAD features, will be mentioned when discussing the Semantics Principle (SemP) in Section 3.1.4.

[6] The features of the determiners in the Figure 3.7 were omitted for reasons of legibility. See Section 3.3 for further details.

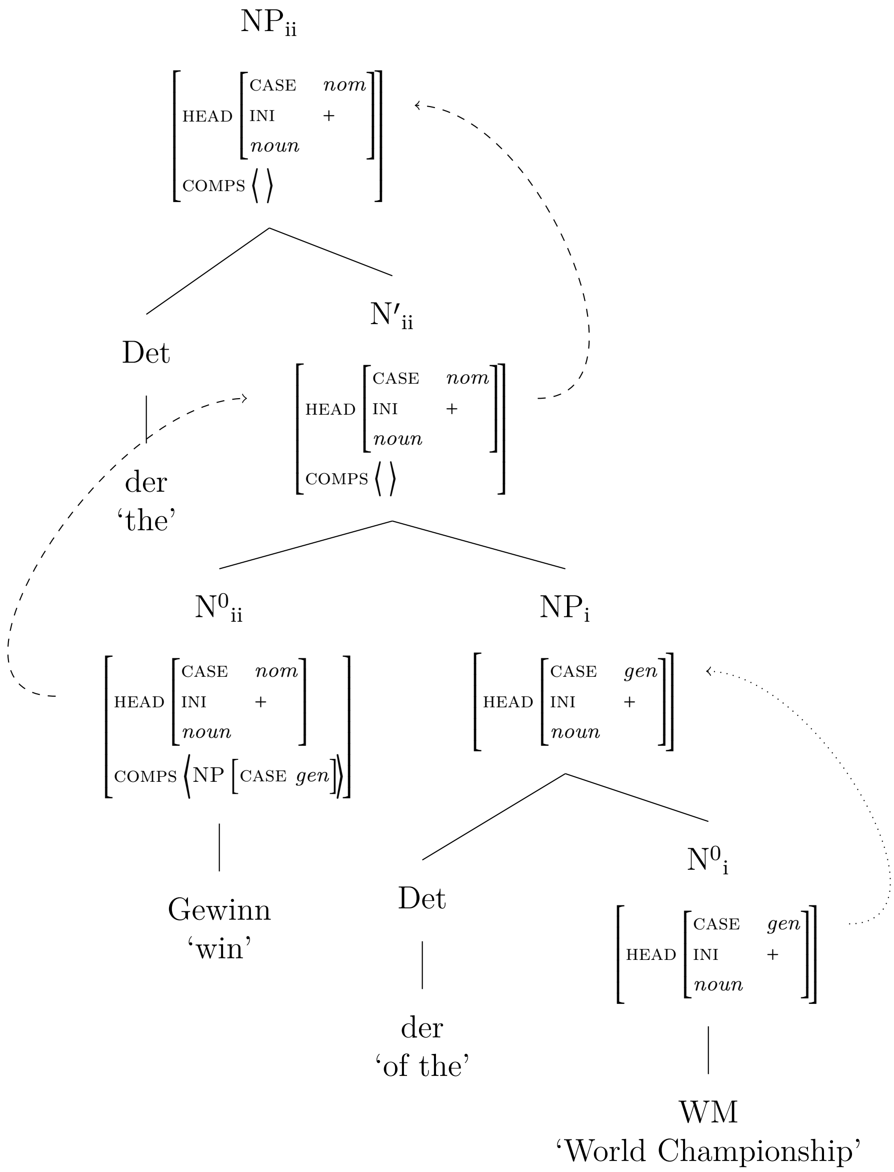

Figure 3.7: HEAD features and structural heads

3.1.3 Distribution of the phrase (ad 3)

The distributional potential of the phrase is determined by the HEAD feature of the HD-DTR. Since the syntactic information inside the HEAD attribute of the HD-DTR is projected to the phrase via the HFP, this information is visible for other constituents which select the phrase. In other frameworks, this fact is of special significance for the definition of head as well. For instance in *Word Grammar*, Hudson (2004: 8) defines *head-hood* as a relation between a head and a phrase in terms of dependency from outside the phrase.

> [H]ead-hood is a relation between a word and a phrase, whereby that word is *the only word in the phrase* which depends on some other word outside the phrase. [Emphasis added; MyP]

Similarly, in MGG, Chierchia (1984: 207) refers to the head of a phrase as follows:

> If [an element] is a head, it will determine basically the features of the phrase, *till the point* at which it is combined with a governing function. [Emphasis added; MyP]

In order to exemplify that the head determines the distribution of its phrase, Figure 3.7 shows that it is relevant for the structural head N^0_{ii} that the NP_i is a noun phrase and bears genitive. The compatibility with respect to this information makes the combination of these two constituents possible. Furthermore, no more structural information is required by a selecting head. For instance, the selecting head N^0_{ii} does not constrain the internal structure of the NP_i, i.e. it does not matter for N^0_{ii} if N^0_i has complements (cf. examples (2a) vs. (2c)), or if it has adjuncts (cf. examples (2a) vs. (2b)), or if it does not have any of them (cf. example (2a)). This fact is taken into account by the so-called *Locality Principle* which disallows selecting heads to constrain the internal structure of its dependents (cf. Pollard and Sag 1987: 143–145; Pollard and Sag 1994: 23–24; and Jacobs 2009: 497–499; a.o.).

(2) a. der Gewinn [$_{NP}$ der WM]
the win the.GEN World Championship
'the win of the World Championship'

b. der Gewinn [$_{NP}$ der [$_{AP}$ fantastischen] WM]
the win the.GEN fantastic World Championship
'the win of the fantastic World Championship'

c. der Gewinn [NP der Wahlen [PP zum Präsidenten]]
the win the.GEN elections to president
'the win of the elections for president'

3.1.4 Interpretation of the phrase (ad 4)

The interpretation of the phrase, that is its semantic information, is driven by a principle which has not been presented yet, but which was mentioned in the discussion in Section 3.1.2. This principle – called *Semantics Principle* (SemP) – is similar to the already known HFP, despite that the SemP applies to the *semantics* part of the sign, i.e. the features and values under CONT.

The semantics of a whole phrase is determined in particular[7] by the semantics of the structural head daughter. Considering for instance the examples (1a) and (1b) above. Although, they are the combination of different linguistic signs, the *main* semantic contribution is in both situations made by *Gewinn* 'win'. In both cases, we are talking about a 'win' which is specified in one case by an argument (i.e. what has been won in example (1a)) and in the other case by an adjunct (i.e. how it has been won in example (1b)).[8] Since the information about the meaning of the phrase is not syntactic but semantic in nature, it is encoded under the CONT attribute and its projection to the phrasal level is hence not covered by the HFP. Therefore, a counterpart of HFP in semantics is needed to ensure the projection of semantic information from the head of a structure to its mother node, or to the phrasal level. This task is accomplished by the SemP which is a constraint applying only to phrases with a head, i.e. only to phrases of type *headed-structure*.

For reasons to be illustrated in detail in Sections 3.2.3 and 3.3, the SemP does not apply in the same way to all of the subtypes of *headed-structure*; to be more specific: Phrases of type *head-adjunct-structure* and *head-specifier-structure* show a different behaviour with respect to the SemP. According to this restriction, the preliminary version of the SemP applies to the types: *head-subject-structure* and *head-complement-structure*. Since one constraint applies to both subtypes, they can be grouped under a supertype called *head-argument-structure*. This reflects the idea proposed here that subjects and complements are arguments, but specifiers are not. On the other hand, specifiers are not adjuncts either and share some

[7]See the discussion of the SemP with respect to adjunct and specifiers in the following sections.

[8]The details on the argument-adjunct distinction will be explained in Section 3.2.

properties with subjects and complements, for instance, they all are affected by the ValP. Thus, a reorganisation of the type hierarchy with further (negative) types (i.e. *non-X-structure*) as was proposed in Müller (2013a: 69–70) is been used here as well.

The type *headed-structure* is divided into two subtypes *head-non-adjunct-structure* and *head-non-argument-structure*. Since adjuncts are clearly not arguments, the *head-adjunct-structure* is a subtype of the latter, and since specifiers are neither arguments nor adjuncts the *head-specifier-structure* is a subtype of both types *head-non-adjunct-structure* and *head-non-argument-structure*, i.e. a case of multiple inheritance. Due to this reorganisation of the type hierarchy, constraints can apply to subjects, complements, and specifiers, or to specifiers and adjuncts.[9] With this modification, the type hierarchy is modelled as Figure 3.8 shows.

The SemP can thus be formulated by means of the type *head-argument-structure* as in (3).[10]

(3) Semantic Principle (SemP) (1st preliminary version)
The CONT value of a headed phrase of type *head-argument-structure* is structure-shared with the CONT value of the head daughter.

But there are some problems with the formulation of the SemP as given in (3). Here, I will address only one difficulty of (3) with respect to agreement across sentences (cf. Müller, 1999: 31–34) and exemplify a second preliminary version of the SemP. Example (4) shows that if two sentences are combined and one referent – in this case *Maria* – is picked up in the second sentence by a pronoun, then some kind of agreement must take place.[11]

[9] See Müller (2013a: 195) for a further development of the negative-types *non-X-structure*, and Van Eynde (2006: 158–160) for further similarities between modifiers and specifiers.

[10] For distinct formulations of the SemP according to different grades of accuracy in the analysis of phenomena, see Pollard and Sag (1987: 99, 104, 109, 110); Pollard and Sag (1994: 48, 56, 322-323); Richter (2000: 368); and Müller (2013a: 69–70, 78).

[11] The coindexing of *Maria* and the pronouns just indicates that the intended reading is one in which *Maria* and the pronouns have the same referent.

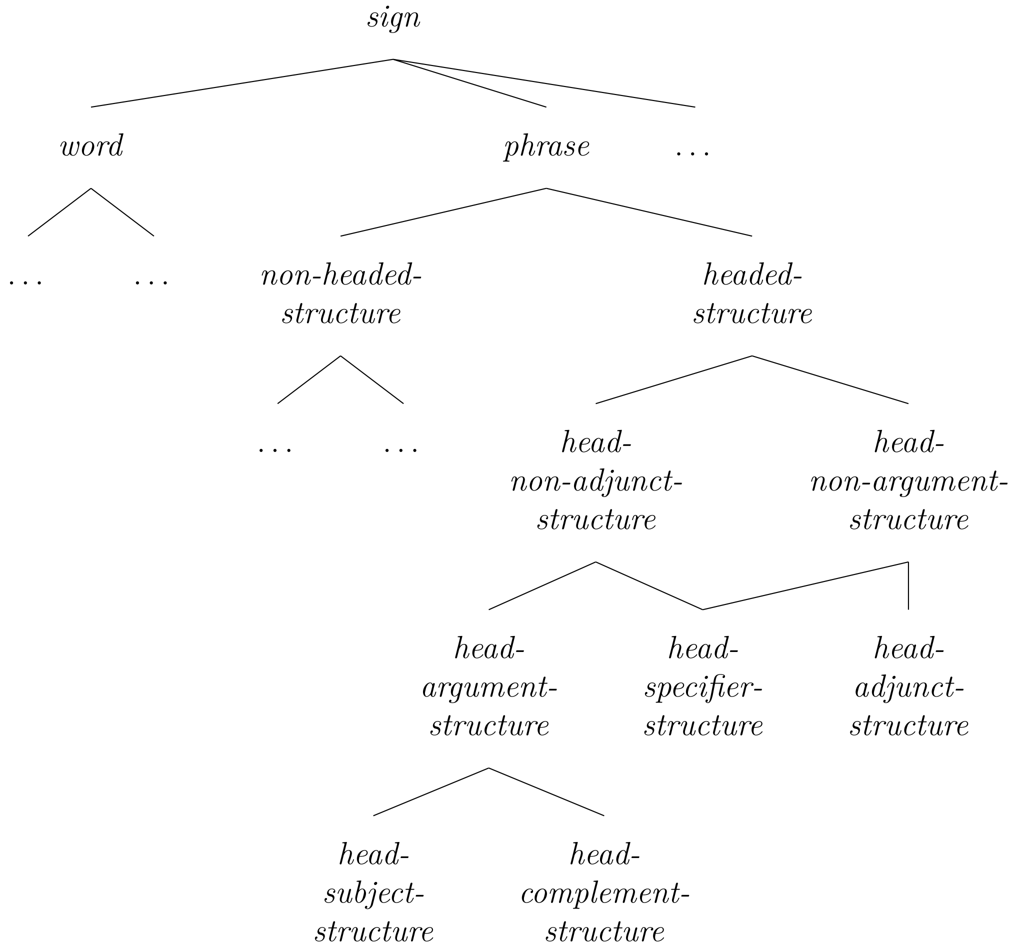

Figure 3.8: Type hierarchy of *sign* (preliminary)

(4) (dass) Maria$_i$ joggt, obwohl sie$_i$ / * er$_i$
that Maria.3.SG.FEM jogs even though she.3.SG.F he.3.SG.M
krank ist.
ill is
'[...] Maria$_i$ jogs even though she$_i$ is ill.'

The pronoun used in example (4) to pick up the referent must agree with the expression *Maria* in person, number, and gender. The pronoun *sie* 'she' is therefore grammatical, while *er* 'he' is not. The relevant features are encoded in the CONT|IND value of *Maria*. Since the relevant phrase *Maria joggt* in example (4) is a phrase of type *head-subject-structure*, the verb *joggt* 'jogs' is licensed as the head daughter and *Maria* as the non-head daughter. According to the SemP in (3) – because a *head-subject-structure* is a subtype of *head-argument-structure* – the CONT value of the HD-DTR is identical to the CONT value of the whole structure. Hence, the IND value of *Maria* would be really deep embedded in the structure. One way to get rid of this problem is to divide the amounts of structure-shared information into two; that is, to distinguish the structure-sharing of the IND value and of the RELS value (cf. (5a) and (5b)) as proposed in (5).

(5) Semantic Principle (SemP) (2nd preliminary version)
For a headed phrase of type *head-argument-structure*:

a. Its CONT|IND value is structure-shared with the CONT|IND value of the head daughter and,
b. its CONT|RELS value is the concatenation of the RELS lists of the head daughter and the non-head daughter.

I am going to exemplify the result of this modification taking a substructure of Figure 3.7, namely N′$_{ii}$ [*Gewinn der WM*] 'win of the World Championship', given as as Figure 3.9 below.

The combination of the nominal head *Gewinn* with the NP *der WM* is licensed by the *head-complement-structure* which is a subtype of the *head-argument-structure*. Hence, the IND value of the HD-DTR N$^0_{ii}$, i.e. $\boxed{1}$, is identical – viz. structure-shared – with the IND value of the resulting structure N′$_{ii}$ by means of the SemP. This reflects the fact that the result of the concatenation N′$_{ii}$ has, for instance, the GEND value *masc*, and not *fem* as the NP$_i$ has. Moreover, the RELS value of the structure is the concatenation of the RELS values of both daughters. Since the noun *Gewinn* is the nominalisation of a verb *gewinnen* 'to win', it has two elementary

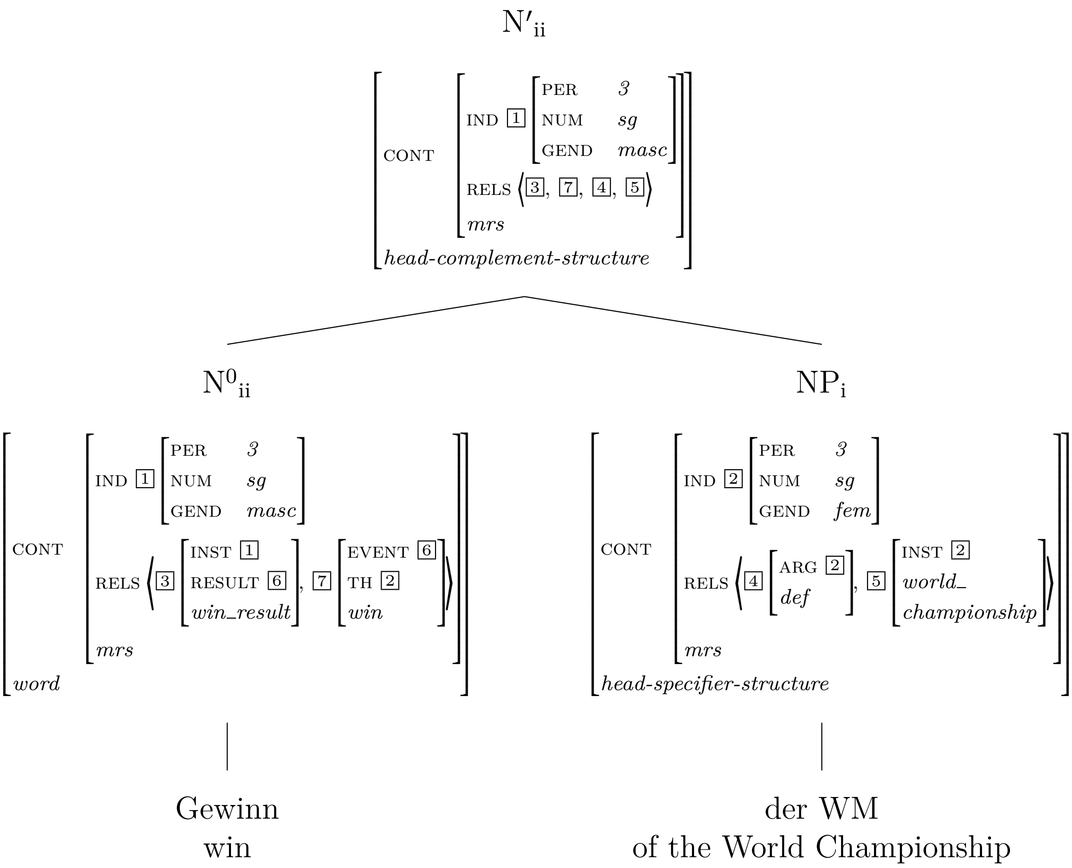

Figure 3.9: Illustration of the Semantics Principle

predications (cf. Section 2.4). The nominalisation is the result state (*win_result*) of an event (*win*). The “winning-event” has a theta-role theme which is fulfilled by the element which is the complement of *Gewinn* (cf. $\boxed{4}$ in example (8)).

As an implicational constraint, the 2nd preliminary version of the SemP can be formalised, as shown in (6).[12] With the reformulation made in (5), not only the RELS value of the head daughter is being projected to (i.e. structure-shared with) the phrase, but also the one of the non-head daughter. That is to say, by means of the SemP the head projects to its phrase what kind of semantic object (IND value) the whole phrase is, e.g. entity vs. event, and by the concatenation of the RELS values of the HD-DTR and the NH-DTR, the semantic relation between head and non-head gets projected to the phrase as well.

(6) Semantic Principle (SemP) (2nd preliminary version)

$$
\textit{head-argument-structure} \rightarrow \begin{bmatrix} \textsc{synsem}|\textsc{loc}|\textsc{cont} & \begin{bmatrix} \textsc{ind} & \boxed{1} \\ \textsc{rels} & \boxed{2} \oplus \boxed{3} \end{bmatrix} \\ \textsc{hd-dtr}|\textsc{synsem}|\textsc{loc}|\textsc{cont} & \begin{bmatrix} \textsc{ind} & \boxed{1} \\ \textsc{rels} & \boxed{2} \end{bmatrix} \\ \textsc{nh-dtr}|\textsc{synsem}|\textsc{loc}|\textsc{cont} & \begin{bmatrix} \textsc{rels} & \boxed{3} \end{bmatrix} \end{bmatrix}
$$

3.1.5 Summarising the notion of ‘head’

In order to exemplify what has been said in the past Sections 3.1.1–3.1.4, I am going to use the bracketed phrase in example (7), which is represented as an AVM in (9).

(7) (ein) fantastischer [*Gewinn* der WM].
a fantastic win the.GEN World Championship
‘a fantastic win of the World Championship.’

As already mentioned, headedness is a relation between one element in a structure and the structure itself, i.e. a vertical relation. The structural head of the NP in (7) is the noun *Gewinn* ‘win’. *Which* properties of the head are projected to

[12] In the remainder of this work, the SemP will have to be modified in order to account for modification and for specification. See for instance, Section 3.2.3.3.

the phrase depends on the attribute-value pairs in the lexical item[13] of the head (cf. AVM (8)). *How* these properties are projected depends on the grammatical constraints (i.e. HFP, SemP, ValP, ID-schemata, LP-rules) which apply to the structure itself (cf. AVM (9)).

The lexical item *Gewinn* is given in (8).[14] It states, for instance, which part of speech it has (cf. *noun*), how many further objects are needed and which properties they have to have (cf. SPR and COMPS), how the complements have to be interpreted (cf. $\boxed{4}$ in RELS), etc.

(8)
$$
\begin{bmatrix}
\text{PHON} & \langle \textit{Gewinn} \rangle \\
\text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{CASE} & \textit{nom}\\ \text{INI} & + \\ \textit{noun} & \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \langle \text{DP}[\textit{nom}]_{\boxed{1}} \rangle \\ \text{COMPS} & \langle \text{NP}[\textit{gen}]_{\boxed{4}} \rangle \end{bmatrix} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{1}\begin{bmatrix} \text{PER} & \textit{3} \\ \text{NUM} & \textit{sg} \\ \text{GEND} & \textit{masc} \\ \textit{ref} & \end{bmatrix} \\ \text{RELS} & \left\langle \begin{bmatrix}\text{INST} & \boxed{1} \\ \text{RESULT} & \boxed{3} \\ \textit{win\_result} & \end{bmatrix}, \begin{bmatrix} \text{EVENT} & \boxed{3}\\ \text{TH} & \boxed{4} \\ \textit{win} & \end{bmatrix} \right\rangle \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\
\textit{word} &
\end{bmatrix}
$$

In order to get this information projected to the phrase, the HFP (for the infor-

[13]In Section 4.4.2, the term *lexical item* will be explained in more detail and distinguished from the term *lexical entry*.

[14]AVM (8) represents a simplistic representation of the noun. For the sake of clarity, I am not considering the underspecification of the CASE value, as well as the optionality of the complements and the subject of the "win-relation". This topics will be discussed in detail in Sections 4.3 and 4.5, respectively.

mation under HEAD), the ValP (to discharge and project the value of VAL), and the SemP (to project the meaning – value of CONT – of the head and to compositionally build the meaning of the structure) apply according to the kind of structure which is licensed (e.g. in (9) a *head-complement-structure*). That is, it depends on the ID-schema used – or in other words: on the phrasal type (e.g. *head-complement-structure* vs. *head-adjunct-structure*) – which constraints are imposed by the ValP and the SemP. Moreover, the linearity inside the phrase, i.e. the precedence relations between words inside the phrase, is constrained by the LP-rules. According to the LP-rule in (44) in Section 2.5.4, in a *head-complement-structure*, the complement will follow the head due to the INI value (+) of the head in (8).

All these constraints refer to the notion of head, i.e. one of the elements which are combined must be able to fulfil the function of the head. But how is it possible that *Gewinn*, but not *der WM* is identified as the head daughter? Which element is licensed as the head daughter is dependent on the type of the phrase. Since the combination of *Gewinn* and *der WM* can only be licensed by the type *head-complement-structure*, the sign which fulfils the constraints on the element of the COMPS list of the other will be licensed as the non-head daughter. Thus, *Gewinn* is identified as a head daughter.

3.2 Arguments and adjuncts

The terms *head*, *argument*, and *adjunct* describe relations between linguistic objects. The term *head* – as explained in detail above – represents a *vertical relation* between the "core" of a structure and the "structure" (or phrase) itself. In contrast, the terms *argument* and *adjunct* describe *horizontal relations* between the head and other elements which combine with it to form a more complex structure (cf. *Y* and *Z*, or *Y* and *W* in Figures 3.10 and 3.11, respectively). Although the distinction between arguments and adjuncts can be considered to be central for linguistic analysis, it has been challenged many times, both from a syntactic (e.g. Przepiórkowski, 1999) as well as from a semantic (e.g. Parsons, 1990) point of view. I am not going into the details *against* the distinction, but offering the differences between both kinds of relations and how they are encoded in HPSG (cf. Machicao y Priemer, 2018a).

The distinction between arguments and adjuncts is a distinction which relies on the dependency relation between two expressions, i.e. between the head *Y* and the

(9)

$$
\begin{bmatrix}
\mathrm{PHON} & \boxed{1} \oplus \boxed{2} \\
\mathrm{SYNSEM}\mid\mathrm{LOC} & \begin{bmatrix}
\mathrm{CAT} & \begin{bmatrix} \mathrm{HEAD} & \boxed{3} \\ \mathrm{VAL} & \begin{bmatrix} \mathrm{SPR} & \boxed{4} \\ \mathrm{COMPS} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \\
\mathrm{CONT} & \begin{bmatrix} \mathrm{IND} & \boxed{5} \\ \mathrm{RELS} & \langle \boxed{6}, \boxed{7}, \boxed{11}, \boxed{12} \rangle \\ \textit{mrs} & \end{bmatrix}
\end{bmatrix} \\
\mathrm{HD\text{-}DTR} & \begin{bmatrix}
\mathrm{PHON}\ \boxed{1} \langle \textit{Gewinn} \rangle & \\
\mathrm{SYNSEM}\mid\mathrm{LOC} & \begin{bmatrix}
\mathrm{CAT} & \begin{bmatrix}
\mathrm{HEAD} & \boxed{3} \begin{bmatrix} \mathrm{CASE} & \textit{nom} \\ \mathrm{INI} & + \\ \textit{noun} & \end{bmatrix} \\
\mathrm{VAL} & \begin{bmatrix} \mathrm{SPR} & \boxed{4} \langle \mathrm{DP}[\textit{nom}]_{\boxed{5}} \rangle \\ \mathrm{COMPS} & \langle \boxed{9} \rangle \end{bmatrix}
\end{bmatrix} \\
\mathrm{CONT} & \begin{bmatrix}
\mathrm{IND} & \boxed{5} \begin{bmatrix} \mathrm{PER} & \textit{3} \\ \mathrm{NUM} & \textit{sg} \\ \mathrm{GEND} & \textit{masc} \\ \textit{ref} & \end{bmatrix} \\
\mathrm{RELS} & \left\langle \boxed{6} \begin{bmatrix} \mathrm{INST} & \boxed{5} \\ \mathrm{RESULT} & \boxed{8} \\ \textit{win\_result} & \end{bmatrix}, \boxed{7} \begin{bmatrix} \mathrm{EVENT} & \boxed{8} \\ \mathrm{TH} & \boxed{9} \\ \textit{win} & \end{bmatrix} \right\rangle \\
\textit{mrs} &
\end{bmatrix}
\end{bmatrix} \\
\textit{word} &
\end{bmatrix} \\
\mathrm{NH\text{-}DTR} & \begin{bmatrix}
\mathrm{PHON}\ \boxed{2} \langle \textit{der WM} \rangle & \\
\mathrm{SYNSEM}\ \boxed{9} & \begin{bmatrix}
\mathrm{CAT}\mid\mathrm{HEAD} & \begin{bmatrix} \mathrm{CASE} & \textit{gen} \\ \textit{noun} & \end{bmatrix} \\
\mathrm{CONT} & \begin{bmatrix}
\mathrm{IND} & \boxed{10} \begin{bmatrix} \mathrm{PER} & \textit{3} \\ \mathrm{NUM} & \textit{sg} \\ \mathrm{GEND} & \textit{fem} \\ \textit{ref} & \end{bmatrix} \\
\mathrm{RELS} & \left\langle \boxed{11} \begin{bmatrix} \mathrm{ARG} & \boxed{10} \\ \textit{def} & \end{bmatrix}, \boxed{12} \begin{bmatrix} \mathrm{INST} & \boxed{10} \\ \textit{world\_} & \\ \textit{championship} & \end{bmatrix} \right\rangle \\
\textit{mrs} &
\end{bmatrix}
\end{bmatrix} \\
\textit{head-specifier-structure} &
\end{bmatrix} \\
\textit{head-complement-structure} &
\end{bmatrix}
$$

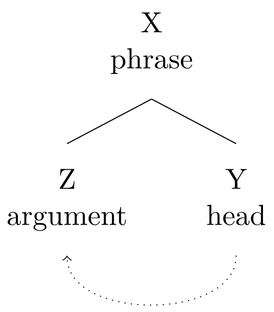

Figure 3.10: Head-argument relation

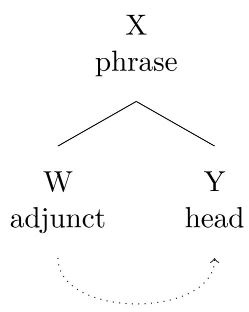

Figure 3.11: Head-adjunct relation

argument *Z*, or between the head *Y* and the adjunct *W*. This dependency relation is assumed to exist on a syntactic as well as on a semantic level (cf. Hudson, 2004; Ackema, 2015). As I will show in the following sections, the syntactic and the semantic dependency do not have to overlap.

With respect to the terminology, both terms “argument” and “adjunct” are often used in syntax, while in semantic analyses the term “modifier” is more commonly used for adjuncts.[15] The term “argument” in syntax is commonly divided into two classes of arguments: “subject” and “complements”, also called “external” and “internal arguments”, respectively. Pollard and Sag (1994: 23) make use of the term “complement” in a wider sense, as the following quote shows.

> Here the notion *complement* is broadly construed to include not only sisters of lexical heads but also certain dependent elements classified as specifiers in GB theory (i.e. subjects, including determiner subjects of NPs).

Here, I am not following this terminological use. Moreover, I am assuming a more “conservative” distinction between specifiers, adjuncts, and arguments, the latter being divided into subject and complements. Differences and similarities between these terms will be clarified in the remainder of this section.

[15] The term “modifier” is sometimes used also as comprising syntactic as well as semantic aspects, see for instance Hirschmann (2015: 24–25). In rare cases, the elements to the left of the head noun are named “modifiers” or “premodifiers” (cf. for instance Vater 1986: 135). This (syntactic) use of the terminology includes determiners, quantifiers, adjectives, pre-nominal genitives, etc.

3.2.1 Argument-Adjunct distinction

The term “argument” is closely related to the term “function”, as used in mathematics or in logic. In this sense, an argument is something that a function needs in order to provide a result. In linguistics, the same reasoning applies as shown in example (10) (cf. Heim and Kratzer 1998: 34–39; Chung and Ladusaw 2004: 2–4; a.o.).

(10) a. $\mathrm{F}' := f : \mathbb{N} \to \mathbb{N}$
$\lambda x : x \in \mathbb{N}\ .\ x^2$

b. $[\![\textit{sleeps}]\!] := f : \mathrm{D}_e \to \{0, 1\}$
$\lambda x : x \in \mathrm{D}_e\ .\ x$ sleeps

The function F′ in example (10a) is defined as a function from natural numbers to natural numbers, mapping every x, which is an element of the set of natural numbers, to the result of x^2, which is also an element of the set of natural numbers. In the same line of reasoning, example (10b) shows that the denotation of a predicate can be defined in terms of functions. Therefore, the predicate *sleeps* is defined as a function from the set of entities (D_e) to the set of truth-values ({0,1}), mapping every x, which is an element of the set of entities, to 0 iff ‘x does not sleep’, or to 1 iff ‘x sleeps’. In example (11) the function in (10b) is applied to the argument *Mary* via Functional Application leading to the truth conditions of the predicate.

(11) $[\lambda x : x \in \mathrm{D}_e\ .\ x \text{ sleeps}](\text{Mary})$ = 1 if Mary sleeps
= 0 if Mary does not sleep.

That means, a predicate – i.e. a noun, a verb, an adjective, etc. – is defined as having some open positions which must be satisfied such that the function can provide a result (a truth-value in example (11)), or can be considered as complete – or at least as less incomplete (cf. Chung and Ladusaw 2004: 3 and Hole 2015: 1284–1286). This implies that the open positions for arguments must be encoded in the function or head. That is to say, a head Y is looking for some object Z in order to build the complete (or less incomplete) complex object X. The head will thus impose some constraints on the argument(s), some of them being semantic others syntactic in nature. Thus, a distinction between semantic and syntactic arguments is sometimes made (and needed) (cf. Lyons 1977a: Sec. 6.3; Lyons 1977b: Sec. 12.4; Jacobs 1994a: 287–288; Chung and Ladusaw 2004: 6–10; and Ackema 2015: 246–251). From a logical point of view, we can reduce the distinction between head, argument, adjunct, and specifier, to a two-fold distinction between function[16] and argument. But, since we are looking at semantic and syntactic aspects of the relation of two linguistic objects, we need a more fine-grained distinction here.

The following list gives some properties often mentioned in the literature[17] which help to distinguish between arguments and adjuncts:

1. the number of arguments is determined by the head, the number of adjuncts is not;
2. the form of arguments (e.g. phrasal type, case inflection) is normally determined by the head, the form of adjuncts is not;
3. the interpretation of arguments is determined by the head, the interpretation of adjuncts is not;
4. arguments can not be iterated, adjuncts can.

In the following Sections 3.2.1.1–3.2.1.4, the distinction between arguments and adjuncts will be discussed and exemplified focusing on the notion of argument. I will focus on the notion of adjunct in Section 3.2.3. In the examples demonstrating the difference, sentences will be used instead of NPs, since the distinction between arguments and adjuncts is clearer with respect to verbal heads.

3.2.1.1 Cardinality (ad 1)

The first distinguishing property is exemplified in (12)–(14). In (12), there are different predicates which need a different number of arguments: *sleep* in (12a) with one argument, *beat* in (12b) with two arguments, and *give* in (12c) with three arguments.

(12) a. [Mary] sleeps.
b. [Mary] beats [Peter].
c. [Mary] gives [Peter] [the car].

The cardinality of arguments of a predicate is commonly named the *valence* of a predicate. In fact, the term valence implies more than only the cardinality.

[16] Instead of "function", we can use as well the terms "predicate" or "head".

[17] See for instance Pollard and Sag (1987: 134–139); Haegeman (1994: 40ff); Jacobs (1994b: 14–32); Przepiórkowski (1999); Ackema (2015); Hole (2015)

As defined by Jacobs (2009: 504), valence is a relational morphosyntactic feature of word forms that encodes how the semantic arguments of a predicate must be realised. This implies the cardinality, but also further morphosyntactic aspects as, for example their case assignment.[18] Trying to alter the cardinality of the predicates leads to ungrammatical sentences. For instance, *sleep* can not have two arguments (cf. 13a), *beat* can not have three arguments (cf. 13b), and *give* can not have one argument[19] (cf. 13c).

(13) a. * [Mary] sleeps [Peter].
b. * [Mary] beats [Peter] [the car].
c. * [Mary] gives.

But this seems not to be the case with adjuncts, which can be freely added to the sentence without yielding ungrammaticality. For instance in (14) four adjuncts were added to each sentence in (12).

(14) a. [Mary] sleeps [in the evening] [after the party] [on the street] [behind the university].
b. [Mary] beats [Peter] [in the evening] [after the party] [on the street] [behind the university].
c. [Mary] gives [Peter] [the car] [in the evening] [after the party] [on the street] [behind the university].

The fact, that arguments are required by the predicate does not mean, that they are always obligatory. Actually arguments can be often dropped, as well as adjuncts can be absent. In example (15a) both arguments are syntactically realised, the subject *Mary* and the complement *a landscape*, but in (15c) the complement has been dropped, though not leading to ungrammaticality. In (15b), we have the same sentence as in (15a), but with an adjunct *for Peter*. Now, what is the difference between dropping an argument (i.e. from (15a) to (15c)) and dropping an adjunct (i.e. from (15b) to (15a))?

[18] See also Lyons (1977b: Sec. 12.4). Following Jacobs' definition if valence – characteristic also in Valence Theory – the so-called *weather verbs* are considered to be zero-valent (cf. Ágel, 2000: 228–230). This kind of examples clarifies the necessity for the distinction between semantic and syntactic arguments.

[19] Cf. Section 4.4.1 to see in which contexts the verb *geben* can be used without complements.

(15) a. [Mary] is painting [a landscape].
b. [Mary] is painting [a landscape] [for Peter].
c. [Mary] is painting.

The answer lies in the interpretations of the sentences with the dropped elements. While sentence (15c) *entails* the existence of some element which is being painted (i.e. the dropped complement), sentence (15a) does not entail the existence of some person for whom a landscape is being painted (i.e. the dropped adjunct) (cf. Jacobs 1994b: 20; Ackema 2015: 248–249; and Hole 2015: 1286–1287).

Summing up, arguments *can* (but do not have to) be obligatory, while adjuncts are always facultative, moreover not-realised arguments are nevertheless entailed by the meaning of the predicate. In Section 4.4 the analysis of optional arguments in NPs will be given.

3.2.1.2 Form (ad 2)

To illustrate point 2 on the list above, I am going to use the German examples (16) and (17), since German has a richer inflectional paradigm in the nominal system. Example (16) shows that depending on the predicate, the complements have a different form by virtue of case assignment. The complement of *unterstützen* 'to support' in (16a) is in its accusative form; in (16b) the complement of *helfen* 'to help' in its dative form, and in (16c) the complement of *gedenken* 'to remember' in its genitive form. Example (16d) shows that it is not possible to use another form as the one selected by the head.

(16) a. [Der Jäger] unterstützt [den Bären].
the.NOM hunter.NOM supports the.ACC bear.ACC
'The hunter supports the bear.'

b. [Der Jäger] hilft [dem Bären].
the.NOM hunter.NOM helps the.DAT bear.DAT
'The hunter helps the bear.'

c. [Der Jäger] gedenkt [des Bären].
the.NOM hunter.NOM remembers the.GEN bear.GEN
'The hunter remembers the bear.'

d. * [Der Jäger] hilft { [den Bären] / [des Bären] }.
the.NOM hunter.NOM helps the.ACC bear.ACC the.GEN bear.GEN

In contrast to the arguments in (16), whose case inflection is dependent on the head, the form of the adjuncts *jeden Tag* 'every day' and *zur Mittagszeit* 'at noon' in (17) is completely independent of the head.

(17) a. [Der Jäger] unterstützt [den Bären] [jeden Tag] [zu-r Mittagszeit].
the hunter supports the bear every.ACC dayACC to-the.DAT lunchtime.DAT
'The hunter supports the bear every day at noon.'

b. [Der Jäger] hilft [dem Bären] [jeden Tag] [zu-r Mittagszeit].
the hunter helps the bear every.ACC dayACC to-the.DAT lunchtime.DAT
'The hunter helps the bear every day at noon.'

c. [Der Jäger] gedenkt [des Bären] [jeden Tag] [zu-r Mittagszeit].
the hunter remembers the bear every.ACC dayACC to-the.DAT lunchtime.DAT
'The hunter remembers the bear every day at noon.'

3.2.1.3 Interpretation (ad 3)

The third property in 3 on the list can be exemplified with examples (12) and (14) repeated here as (18) and (19). The interpretation, in terms of theta-roles, of the arguments *Mary*, *Peter*, and *the car* depends on the head. *Mary* in (18a) is interpreted as the theme of *sleep*, but in (18b) as the agent of *beat*, just as *Peter* is interpreted as the theme of *beat* in (18b), but as the goal of *give* in (18c).

(18) a. [Mary]$_{\text{THEME}}$ sleeps.

b. [Mary]$_{\text{AGENT}}$ beats [Peter]$_{\text{THEME}}$.

c. [Mary]$_{\text{AGENT}}$ gives [Peter]$_{\text{GOAL}}$ [the car]$_{\text{THEME}}$.

For adjuncts, this restriction does not hold. The interpretation of the adjuncts *in the evening* and *after the party* as temporal adjuncts, and of *on the street* and *behind the university* as local adjuncts is – as examples (19a)–(19c) show – completely independent of the predicate.

(19) a. [Mary] sleeps [in the evening]$_{\text{TEMP}}$ [after the party]$_{\text{TEMP}}$ [on the street]$_{\text{LOC}}$ [behind the university]$_{\text{LOC}}$.

b. [Mary] beats [Peter] [in the evening]$_{\text{TEMP}}$ [after the party]$_{\text{TEMP}}$ [on the street]$_{\text{LOC}}$ [behind the university]$_{\text{LOC}}$.

c. [Mary] gives [Peter] [the car] [in the evening]$_{\text{TEMP}}$ [after the party]$_{\text{TEMP}}$ [on the street]$_{\text{LOC}}$ [behind the university]$_{\text{LOC}}$.

3.2.1.4 Iteration (ad 4)

The fourth property in 4 on the list is closely related to the properties 2 and 3. As (20b) in comparison to (20a) shows, arguments can not be iterated without leading to ungrammaticality. However, adjuncts can be iterated as can be observed in the sentences in (19).

(20) a. [Mary]$_{\text{AGENT}}$ beats [Peter]$_{\text{THEME}}$.

b. * [Mary]$_{\text{AGENT}}$ beats [Peter]$_{\text{THEME}}$, [John]$_{\text{THEME}}$.

The reason for the non-iterability of arguments lies in the fixed cardinality of arguments of a particular predicate. In HPSG, this is expressed in the valence list of the head and the constraints imposed on phrases of type *head-non-adjunct-structure*. Arguments are "selected" or listed as elements of the VAL lists of the head daughter. By the combination of a head daughter with an argument, i.e. in a phrase of type *head-non-adjunct-structure*, the VAL list is reduced by the element represented by the non-head daughter, viz. the argument (cf. ValP in Section 2.5.5).[20] Therefore, if *Peter* in example (20b) has been already combined with the head *beats*, there is no way to combine and to interpret *John* as argument too, since *Peter* has already satisfied this argument position.[21]

3.2.2 Head-Argument combination in HPSG

Now, from a descriptive perspective, the difference between arguments and adjuncts is clear. And looking at the illustration in Figure 3.10 again – here repeated and

[20] By this formulation specifiers are included in the class of arguments, since SPR is an attribute of VAL too. In Section 3.3, the similarities and differences between arguments, adjuncts, and specifiers will be worked out. Selection via VAL attribute is a similarity between arguments and specifiers.

[21] In MGG, this phenomenon is accounted for by means of the *Case-Filter* and the *Theta-Criterion* (cf. Chomsky, 1981: 36 & 49).

completed as Figure 3.12 – the relation between an argument *Z* and the head *Y* forming a phrase *X*, can be described in the following way: The head *Y* imposes several constraints on an element *Z* such that *Y* and *Z* can be combined to form a phrase *X*. Thereby, the values of HEAD, VAL, and IND of the head daughter are projected to the phrase, and the IND value of the non-head daughter is incorporated in the RELS attribute of the head, as long as the argument is also a semantic argument.[22]

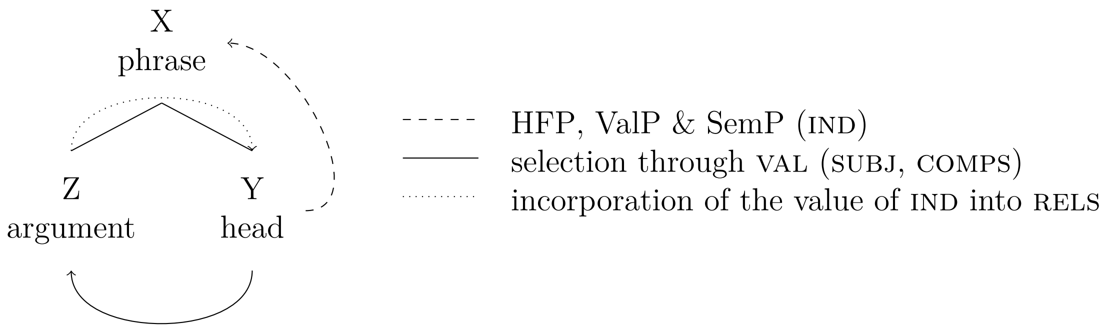

Figure 3.12: Head-argument relation

In HPSG, the constraints of the head imposed on arguments are represented at different places of the head's AVM. For instance,

1. ad Section 3.2.1.1, the *cardinality of arguments* is the sum of the cardinality of the SUBJ list and of the COMPS list of the structural head;
2. ad Section 3.2.1.2, the *form of arguments* is specified as the constraints on the single elements of the SUBJ and COMPS lists;
3. ad Section 3.2.1.3, the *interpretation of the individual arguments* is constrained through structure sharing between the indices of the SUBJ and COMPS lists and the attributes in the RELS list; and
4. ad Section 3.2.1.4, the *iteration of arguments* is ruled out by the ValP, since arguments of the head, which have been already combined with the head, are discharged of its VAL lists;

[22] For instance, the subject pronoun *es* 'it' for weather verbs in German, does not fulfil any theta-role in the elementary predication of the head, being not a semantic argument of the predicate. Thus, its IND value is not incorporated in the RELS value of the head.

5. as long as all these constraints apply, a phrase built of a head and an argument, i.e. subject or complement, is licensed by the Head-Subject Schema or the Head-Complement Schema, respectively (cf. Section 2.5.3); and the position of the argument relative to the head is constrained by virtue of the respective LP-rule (cf. Section 2.5.4).

3.2.3 Head-Adjunct combination in HPSG

So far nothing has been said about the combination between a head and an adjunct. That is, assuming Figure 3.11, how can we describe the relation between an adjunct W and a head Y to form a phrase X? And how is their combination licensed? There are three possibilities that have been considered in the literature to combine an adjunct with a head (cf. for instance Pollard and Sag 1987: 158; Przepiórkowski 1999: 255; Hole 2015: 1296; Bücking 2016).

- a head-adjunct combination is licensed by a *grammar rule*/construction, i.e. neither the head selects the adjunct, nor vice versa;
- the head selects the adjunct, i.e. the *head operates as a function*, and takes the adjunct as an "argument"; or
- the adjunct selects the head, i.e. the *adjunct operates as a function*, and takes the head as an "argument".

In order to decide which of these possibilities is the best fit to account for the relation between heads and adjuncts, we must take the properties into consideration, which were used and exemplified to make a distinction between arguments and adjuncts in Section 3.2.1, repeated below and complemented by one further item (cf. item 5).

1. The number of arguments is determined by the head, the number of adjuncts is not.
2. The form of arguments (e.g. phrasal type, case inflection) is determined by the head, the form of adjuncts is not.
3. The interpretation of arguments is determined by the head, the interpretation of adjuncts is not.

4. Arguments can not be iterated, adjuncts can.
5. A phrase built by a head and an adjunct has the same category and syntactic distribution as the head without the adjunct.[23]

The first possibility – assuming a special rule to combine head and adjunct – is for instance used in some semantic accounts. A rule called *Predicate Modification* is postulated in order to combine the denotation of head and adjunct (cf. Heim and Kratzer, 1998: 65–66 & 83).[24] Now, to see how Predicate Modification works, let us assume that nouns and adjectives are both predicates of type $\langle e,t \rangle$, i.e. they are functions from entities to truth-values.

(21) a. $[\![\mathit{black}]\!] := f : \mathrm{D}_e \rightarrow \{0,1\}$
$\lambda x : x \in \mathrm{D}_e \;.\; x \text{ is black}$

b. $[\![\mathit{tie}]\!] := f : \mathrm{D}_e \rightarrow \{0,1\}$
$\lambda x : x \in \mathrm{D}_e \;.\; x \text{ is a tie}$

Treating the adjective *black* and the noun *tie* both as elements of type $\langle e,t \rangle$, there is no way to combine both by means of Functional Application, as it was by the combination of a head with its argument (cf. example (11)). Therefore, a rule for the combination of two elements of the same type can be proposed.

(22) *Predicate Modification* (Heim and Kratzer, 1998: 65)
If α is a branching node, $\{\beta, \gamma\}$ is the set of α's daughters, and $[\![\beta]\!]$ and $[\![\gamma]\!]$ are both in $\mathrm{D}_{\langle e,t \rangle}$ then
$[\![\alpha]\!] \equiv \lambda x \in \mathrm{D}_e \;.\; [\![\beta]\!](x) = [\![\gamma]\!](x) = 1$

Applying the rule in (22) to *black* in (21a) and *tie* in (21b), i.e. assuming that $[\![\beta]\!] \equiv [\![\mathit{black}]\!]$, and $[\![\gamma]\!] \equiv [\![\mathit{tie}]\!]$, then the denotation of *black tie*, i.e. $[\![\alpha]\!] \equiv [\![\mathit{black\ tie}]\!]$, can be derived as shown in (23).

(23) $[\![\mathit{black\ tie}]\!]$
$\equiv \lambda x \in \mathrm{D}_e \;.\; [\lambda x' \in \mathrm{D}_e \;.\; x' \text{ is black}](x) = [\lambda x'' \in \mathrm{D}_e \;.\; x'' \text{ is a tie}](x) = 1$
$\equiv \lambda x \in \mathrm{D}_e \;.\; x \text{ is black} = x \text{ is a tie} = 1$

[23] This point was not relevant with respect to the argument-adjunct distinction, and was therefore not mentioned in the past section, but it is relevant with respect to the classification of adjuncts.

[24] This rule was first proposed by Higginbotham (1985: 564), and named *theta-identification*. Heim and Kratzer (1998: 66–73) show too how the combination of a modifier and a head can work semantically with Functional Application, i.e. assuming the adjunct as a function and the head as its argument.

The denotation of *black tie* we get from Predicate Modification is the entity (more accurately: the set of entities) that is black and a tie at the same time. Surely, the semantic derivation of *black tie* by means of Predicate Modification captures correctly the truth conditions of the expression. Nevertheless, assuming the head-adjunct combination by means of an external grammar rule leads to some problems. At this point, I am going to address only two difficulties of such an approach. Firstly, this rule is not endocentric, i.e. there is no element which can (or need to) be chosen as the head of the structure. From a semantic point of view, this fact may not pose any problems, since the type of $[\![\textit{black tie}]\!]$ is $\langle e, t\rangle$, that is the same type as $[\![\textit{tie}]\!]$ or $[\![\textit{black}]\!]$.[25] But syntactically, this fact is indeed problematic, since according to the property in 5 on the list above, it is relevant whether the construction is of the same category as the adjunct (i.e. an adjective in (23)) or the head (i.e. a noun in (23)). Secondly, as pointed out in Pollard and Sag (1987: 160):

> [...] if the full range of acceptable head-adjunct pairings is to be accounted for, a very large number of structurally similar additional rules will be needed.

That is to say, syntactic rules involving Predicate Modification for the combination of an adjunct and a head will have to ensure that only suitable parts of speech are combined. For instance, an adjective *good* and an intransitive verb *sleep* should not combine (cf. example (24a)), neither should an adverb *well* with a noun *sleep* (cf. example (24b)), even though they all are of type $\langle e, t\rangle$. All these possible combinations would have to be ruled out by single rules defining possible combinations of parts of speech.

(24) a. He sleeps {*good/well}.
     b. His {good/*well} sleep made me envious.

The second and the third possibilities to account for the combination of a head with an adjunct implied a function-argument relation between adjunct and head. The list of facts distinguishing between arguments and adjuncts (with exception of item 5) speaks for the adjunct to be the predicate taking the head as its argument. The list presented above is specified here with respect to the characteristics of the adjunct.

[25] As far as we are dealing with intersective modifiers no problems arise. Further difficulties with Predicate Modification are discussed in Machicao y Priemer and Winckel (2015), for instance with respect to subsective modifiers in Spanish and French.

1. The cardinality of adjuncts is not determined by the head, but each adjunct is related to only one head.

2. The form of adjuncts (e.g. phrasal type) is not determined by the head. For instance, a head noun might be modified by a relative clause, an adjective, a prepositional phrase, etc. But the other way around, the modification is more restricted. For example, a relative clause can only modify a noun.

3. The interpretation of an adjunct is not determined by the head, but in some sense, the entity/event introduced by the head is interpreted as an argument of the predicate introduced by the adjunct.[26]

4. There are no restrictions of the head with respect to how many adjuncts can be in a structure.

5. A phrase built by a head and an adjunct has the same category and syntactic distribution as the head without the adjunct.

That is to say, an adjunct determines the cardinality of the head (i.e. namely only one), the form of the head (e.g. its phrasal type), and adds something to its interpretation. But syntactically seen, the head continues to determine the HEAD value of the phrase. Thus, the relation between adjunct and head is quite more complex than the one between head and argument.[27]

3.2.3.1 The head-selecting adjunct

In order to account for these facts, Pollard and Sag (1994: 55–57) propose an account in which the adjunct selects the head. In Pollard and Sag (1987: 157–168),[28] the head-adjunct combination was worked out the other way around, letting the head select the adjunct. But, as they point out in Pollard and Sag (1994: 55)

> [...] that solution has resisted extension to a satisfactory account of how adjuncts contribute their content to the content of the phrases they occur in.

[26] See for instance the discussion of AVM (27), particularly the semantic relation between the adjective *proud*, its complement *daughters*, and the head *mothers*.

[27] This fact is also reflected in the several different accounts for adjunction in the linguistic literature. For an overview, see Hole (2015: 1296–1302).

[28] See also Bouma et al. (2001) for a similar approach.

Hence, I am adopting here the solution in Pollard and Sag (1994).[29] For the selection of the head in a modifying relation, a new attribute MODIFIED (MOD) is introduced in the feature geometry of HPSG. This attribute is comparable to the *synsem* valued VAL attributes SUBJ or COMPS and constrains the objects which can be combined with the adjunct, i.e. MOD constrains the *synsem* of the head.[30] In comparison to SUBJ or COMPS, which are attributes of the VAL attribute of the head, MOD is a HEAD attribute of the adjunct (cf. example (26)). MOD is implemented as a HEAD feature, because it must be projected to the phrasal level. For instance, in example (25a) the adjective *schwarzer* 'black' must select its head, in the same way as the more complex AP *auf ihre Töchter stolze* 'proud of their daughters' in (25b) does.

(25) a. [$_{\text{AP}}$ schwarzer] Rabe
black raven

b. [$_{\text{AP}}$[$_{\text{PP}}$ auf ihre Töchter] stolze] Mütter
of their daughters proud mothers

'mothers proud of their daughters'

Let us illustrate this fact explaining the differences between the AVMs (26) and (27) of the adjectives *schwarzer* 'black' as used in (25a) and *stolze* 'proud' as used in (25b).[31]

Both adjectives are inflected word forms of type *word*. They are inflected for person, number, and gender (cf. SYNSEM|LOC|CONT|IND). The values relevant for agreement are structure-shared with the IND value of the noun they modify (cf. $\boxed{1}$). The HEAD value of both is of type *adjective* (*adj*). The HEAD attribute MOD specifies which kind of object the adjunct modifies. In both cases, the adjuncts modify an incomplete NP (cf. N′) with its IND and RELS values being constrained

[29] Pollard and Sag (1987: 161–168) introduced a head attribute ADJUNCTS whose value is a *set* of syntactic constraints for elements, which could be treated as adjuncts. Since adjuncts can be iterated, the single elements of the set are not discharged after an adjunct-head combination, like elements of the VAL *lists* are. In order to achieve this, they built in an extra condition for their Head-Adjunct Schema (cf. Pollard and Sag, 1987: 166).

[30] Objects which cannot be used as adjuncts, or which simply are not instantiated as such, get the MOD value *none*.

[31] For reasons of clarity, in the AVMs (26) and (27), the features for person, number, and gender are given fully specified, although, the word forms *schwarzer* and *stolze* are not maximal specific in this respect, e.g. *schwarzer* can be also inflected for 3rd person, plural, and *stolze* for 3rd person, singular.

(26)
$$\begin{bmatrix} \textsc{phon} & \left\langle \textit{schwarzer} \right\rangle \\ \textsc{synsem}|\textsc{loc} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textsc{mod} & \mathrm{N'}\!: \begin{bmatrix} \textsc{ind} & \boxed{1} \\ \textsc{rels} & \boxed{2} \end{bmatrix} \\ \textit{adj} & \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{comps} & \left\langle\ \right\rangle \end{bmatrix} \end{bmatrix} \\ \textsc{cont} & \begin{bmatrix} \textsc{ind} & \boxed{1} \begin{bmatrix} \textsc{per} & \textit{3} \\ \textsc{num} & \textit{sg} \\ \textsc{gend} & \textit{masc} \\ \textit{index} & \end{bmatrix} \\ \textsc{rels} & \left\langle \begin{bmatrix} \textsc{th} & \boxed{1} \\ \textit{black} & \end{bmatrix} \right\rangle \oplus \boxed{2} \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\ \textit{word} & \end{bmatrix}$$

(27)
$$\begin{bmatrix} \textsc{phon} & \left\langle \textit{stolze} \right\rangle \\ \textsc{synsem}|\textsc{loc} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textsc{mod} & \mathrm{N'}\!: \begin{bmatrix} \textsc{ind} & \boxed{1} \\ \textsc{rels} & \boxed{2} \end{bmatrix} \\ \textit{adj} & \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{comps} & \left\langle \mathrm{NP}[\textit{auf}]_{\boxed{3}} \right\rangle \end{bmatrix} \end{bmatrix} \\ \textsc{cont} & \begin{bmatrix} \textsc{ind} & \boxed{1} \begin{bmatrix} \textsc{per} & \textit{3} \\ \textsc{num} & \textit{pl} \\ \textsc{gend} & \textit{fem} \\ \textit{index} & \end{bmatrix} \\ \textsc{rels} & \left\langle \begin{bmatrix} \textsc{source} & \boxed{3} \\ \textsc{exp} & \boxed{1} \\ \textit{proud} & \end{bmatrix} \right\rangle \oplus \boxed{2} \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\ \textit{word} & \end{bmatrix}$$

to be structure-shared (cf. $\boxed{1}$ and $\boxed{2}$). The abbreviation N′ states that the object that is to be modified is incomplete – hence, N′ instead of NP – more precisely, it is a noun phrase without determiner.

Now, the difference between both adjuncts lays in the values of their VAL attributes. While *stolze* 'proud' has an element in its COMPS list, *schwarzer* 'black' does not. The adjective *stolze* 'proud' takes an NP as a complement which is marked with the preposition *auf*.[32] The IND value of the complement NP is structure-shared with the value of SOURCE in the *proud* relation. That is to say, in example (25b), the adjective introduces a *proud* relation in which the *daughters* get the theta-role "source" and the *mothers* the theta-role "experiencer" of the "proudness", marked with the SOURCE and EXPERIENCER (EXP) attributes.[33] On the contrary, the adjective *schwarzer* 'black' does not have a complement, i.e. the list of the COMPS attribute is empty, but the modified noun serves as the "theme" of the *black* relation. More precisely, the IND value of the modified noun is structure-shared with the value of the TH attribute in the *black* relation. For both, *schwarzer* and *stolze*, the value of the RELS attribute of the modified noun is concatenated – or appended – with the RELS value of the adjunct.

Now, since *stolze* 'proud' in example (25b) has the complement *auf ihre Töchter* 'of their daughters', the complex AP *auf ihre Töchter stolz* 'proud of their daughters' must have the MOD attribute as well in order to be able to modify a noun. The complex AP is licensed by the Head-Complement Schema (cf. AVM (28)), and by virtue of the HFP the value of the HEAD attribute of the head daughter is structure-shared with the value of the HEAD attribute of the phrase. Hence, the MOD attribute is available both at word level (as needed in (25a)) and at phrasal level (as needed in (25b)).

According to this illustration of the feature geometry with the MOD attribute, the properties 1–4 pointed out on the list above can be correctly described. What is needed now is the ID-schema that licenses the combination of a head and an adjunct.

---

[32] The preposition *auf* 'on' in this case is being treated as a *dummy preposition*, that means, only as a case marker, but not as a preposition in the narrower sense. See for instance Zubizarreta (1985: 252–257); Fries (1988a: 30–31); and Machicao y Priemer (2010: 15–23).

[33] At this point, it becomes clear to which extent the adjunct determines some aspects of the interpretation of the structural head as it was pointed out in property 3 on the list given above.

(28)
$$
\begin{bmatrix}
\textsc{phon} & \left\langle \textit{auf ihre Töchter stolze} \right\rangle \\
\textsc{synsem}|\textsc{loc} & \begin{bmatrix}
\textsc{cat} & \begin{bmatrix}
\textsc{head} & \begin{bmatrix}
\textsc{mod} & \mathrm{N}'\!: \begin{bmatrix} \textsc{ind} & \boxed{1} \\ \textsc{rels} & \boxed{2} \end{bmatrix} \\
\multicolumn{2}{l}{\textit{adj}}
\end{bmatrix} \\
\textsc{val} & \begin{bmatrix} \textsc{comps} & \left\langle\ \right\rangle \end{bmatrix}
\end{bmatrix} \\
\textsc{cont} & \begin{bmatrix}
\textsc{ind} & \boxed{1} \begin{bmatrix} \textsc{per} & \textit{3} \\ \textsc{num} & \textit{pl} \\ \textsc{gend} & \textit{fem} \\ \multicolumn{2}{l}{\textit{index}} \end{bmatrix} \\
\textsc{rels} & \left\langle \begin{bmatrix} \textsc{source} & \boxed{3} \\ \textsc{exp} & \boxed{1} \\ \multicolumn{2}{l}{\textit{proud}} \end{bmatrix} \right\rangle \oplus \boxed{2} \\
\multicolumn{2}{l}{\textit{mrs}}
\end{bmatrix}
\end{bmatrix} \\
\textsc{hd-dtr} & \begin{bmatrix} \textsc{phon} & \left\langle \textit{stolze} \right\rangle \end{bmatrix} \\
\textsc{nh-dtr} & \begin{bmatrix} \textsc{phon} & \left\langle \textit{auf ihre Töchter} \right\rangle \\ \multicolumn{2}{l}{\textsc{synsem}|\textsc{loc}|\textsc{cont}|\textsc{ind}\ \boxed{3}} \end{bmatrix} \\
\multicolumn{2}{l}{\textit{head-complement-structure}}
\end{bmatrix}
$$

3.2.3.2 The Head-Adjunct Schema

A phrase built of an adjunct and a head is of type *head-adjunct-structure*, which is a subtype of *headed-structure*. Pollard and Sag (1994: 56) give the following description of a phrase of type *head-adjunct-structure*.

(29) ID-schema 3: Head-Adjunct Schema
[...] a phrase with DTRS value of sort *head-adjunct-structure* (*head-adj-struc*), such that the MOD value of the adjunct daughter is token-identical to the SYNSEM value of the head daughter.

As we have seen in AVM (28), the internal structure of the adjunct can be complex, too. In our example (25b) the adjunct contained a complement. By virtue of the ValP[34], the valence lists of the head – but not the one of the adjunct – will be projected. According to Müller (2013a), the valence lists of the adjunct must be empty in order to prevent ungrammatical phrases such as (30b) – taken from Müller (2013a: 75).

(30) a. die Wurst [$_{\text{PP}}$ in der Speisekammer]
the sausage in the pantry

b. * die Wurst [$_{\text{PP}}$ in]
the sausage in

In example (30a) the PP *in der Speisekammer* 'in the pantry' consists of a head *in* and a complement *the pantry*. The MOD value of the head *in* is projected to the PP *in der Speisekammer* of type *head-complement-structure* (cf. AVM (28)) which can be combined with the head *Wurst* 'sausage'. The problem in (30b) is that without the extra restriction that the valence lists of the adjunct must be empty the combination of *Wurst* and *in* would be licensed to yield the ungrammatical phrase in (30b).

Including this further condition to the Head-Adjunct Schema of Pollard and Sag as presented in (29), a formalisation of it in form of an implicational constraint would be as presented in (31).[35]

[34] See also the discussion of the Locality Principle in Section 3.1.3.

[35] Take into account that Pollard and Sag (1994) assume a DAUGTHERS (DTRS) attribute which contains the information of the head and the non-head daughters. Furthermore, they allow for flat structures. In the present account, I am working with binary structures and there is no DTRS attribute subsuming the HD-DTR and the NH-DTR (cf. Section 2.5.3).

(31) ID-schema 3: Head-Adjunct Schema

$$\textit{head-adjunct-structure} \rightarrow \begin{bmatrix} \textsc{synsem}|\textsc{loc}|\textsc{cont}\ \boxed{1} \\ \textsc{hd-dtr}|\textsc{synsem}|\textsc{loc}|\textsc{cat}\ \boxed{2} \\ \textsc{nh-dtr}|\textsc{synsem}|\textsc{loc} \begin{bmatrix} \textsc{cat} \begin{bmatrix} \textsc{head}|\textsc{mod}\ \boxed{2} \\ \textsc{val} \begin{bmatrix} \textsc{spr} & \langle\ \rangle \\ \textsc{subj} & \langle\ \rangle \\ \textsc{comps} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \\ \textsc{cont}\ \boxed{1} \end{bmatrix} \end{bmatrix}$$

3.2.3.3 Revision of the Semantics Principle

Having defined the type *head-adjunct-structure*, there was an open issue in Section 3.1.4 that can be complemented now. The SemP introduced in Section 3.1.4 was only constrained for linguistic objects of type *head-argument-structure* (cf. (5) repeated here as (32)), although objects of type *head-adjunct-structure* must also project their semantic content.

(32) Semantic Principle (SemP) (2^{nd} preliminary version)
For a headed phrase of type *head-argument-structure*:

a. Its CONT|IND value is structure-shared with the CONT|IND value of the head daughter and,
b. its CONT|RELS value is the concatenation of the RELS lists of the head daughter and the non-head daughter.

Now, the formulation of the SemP in (32) can be complemented for objects of type *head-adjunct-structure* with the clause (33b-i) which states that in a phrase built of a head and an adjunct, the CONT value of the *adjunct* is projected to the phrase. Since the IND and RELS values of the head are structure-shared with the IND and RELS values of the adjunct (cf. AVM (28)), it is ensured that the head's content is incorporated into the phrase's content.

(33) Semantic Principle (SemP) (3^{rd} preliminary version)
For a headed phrase,

a. if the headed phrase is of type *head-argument-structure*:
   i. its CONT|IND value is structure-shared with the CONT|IND value of the head daughter and,

ii. its CONT|RELS value is the concatenation of the RELS lists of the head daughter and the non-head daughter;

b. if the headed phrase is of type *head-adjunct-structure*:

i. its CONT value is structure-shared with the CONT value of the non-head daughter.

The formalisation of the SemP in form of an implicational constraint including the new clause (33b-i), i.e. for these both subtypes of *headed-structure*, can be given as in (34).

(34) Semantic Principle (SemP) (3rd preliminary version)

$$\textit{headed-structure} \;\rightarrow\; \begin{bmatrix} \text{SYNSEM}|\text{LOC}|\text{CONT} \begin{bmatrix} \text{IND} & \boxed{1} \\ \text{RELS} & \boxed{2} \oplus \boxed{3} \end{bmatrix} \\ \text{HD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CONT} \begin{bmatrix} \text{IND} & \boxed{1} \\ \text{RELS} & \boxed{2} \end{bmatrix} \\ \text{NH-DTR}|\text{SYNSEM}|\text{LOC}|\text{CONT} \begin{bmatrix} \text{RELS} & \boxed{3} \end{bmatrix} \\ \textit{head-argument-structure} \end{bmatrix} \vee \begin{bmatrix} \text{SYNSEM}|\text{LOC}|\text{CONT} \; \boxed{1} \\ \text{NH-DTR}|\text{SYNSEM}|\text{LOC}|\text{CONT} \; \boxed{1} \\ \textit{head-adjunct-structure} \end{bmatrix}$$

3.2.3.4 Summary: The Head-Adjunct combination in HPSG

The relation between a head Y and an adjunct W to form a phrase X is – as already mentioned – more complicated than the one between an argument and its head. Here, I am going to summarise the most important aspects considered in Section 3.2.3, taking the Figure 3.11 and complement it with the discussed facts resulting in Figure 3.13 which illustrates the relations between head, adjunct, and phrase.

The adjunct selects the head through the constraints imposed in its MOD feature. It constrains the part of speech of the head and determines through structure sharing some aspects of the interpretation. The CONT value of the head is incorporated in the adjuncts CONT value, such that the adjunct defines the role of the head in the relation provided by the adjunct. By virtue of (the extension of) the SemP, the

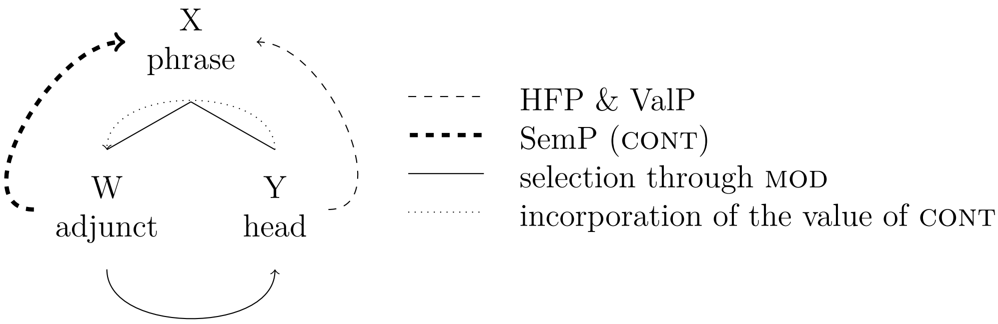

Figure 3.13: Head-adjunct relation

CONT value of the adjunct is structure-shared with the CONT value of the phrase. Since the IND of the head is structure-shared with the IND of the adjunct, it is guaranteed that the phrase is of the same semantic type as the head. So far, the four properties 1–4 of the list given at the beginning of Section 3.2.3 are worked off.

Regarding only these four items, a question emerges: Why is the head considered the structural head of the phrase and not the adjunct?[36] The answer to this question is given by the item 5 on our list, repeated here:

5. A phrase built by a head and an adjunct has the same category and syntactic distribution as the head without the adjunct.

That means, the whole phrase, which is licensed by the Head-Adjunct Schema, has the same syntactic category, the same syntactic distribution, and the same valence as the head, and not as the adjunct. These properties are projected from the head to the phrase by virtue of the HFP and the ValP, since both are principles for objects of type *headed-structure*. Therefore, although the adjunct selects the head, it is the head which determines the main syntactic properties of the phrase. Hence, the adjunct can still be considered a (syntactic) dependent of the head.

[36] In fact, in cartographic approaches in MGG, adjuncts are represented as specifiers of functional phrases whose heads are functional empty elements, a particle, or an affix. That is to say, the actual (structural) head is – strictly speaking – not the (lexical) head of the structure any more. See, for instance Cinque (1999); and for a comment on Cinque's approach, see Hole (2015: 1303–1304).

3.3 Specifiers

The notion of specifier is in many ways the most controversial in comparison to the notions explained so far.[37] Two questions arise when explaining the notion of specifiers:

- What is the status of a specifier, i.e. is a specifier a relation (like “argument”) or a category (like “determiner”)?
- What does it mean for an element to be a specifier?

Although some elements belonging to specific word classes are typically used as specifiers (e.g. determiners in NPs), as it will be shown in example (35) below, elements belonging to different parts of speech (or phrasal types) can be used in a specifier relation. Thus, the answer to the first question is: *relation.* Like arguments and adjuncts, specifiers represent a relation between two elements, and not a word class/part of speech. The close relation between part of speech and the specifier relation can be illustrated for instance by the terminological choices in Payne and Huddleston (2002: 354–358). They do not speak about “specifiers”, but about “determiners” and more specifically about the “determiner function”. They call “determiner” the function which can be fulfilled by elements belonging to different word classes (or phrasal types) in order to build a complete NP. Typically, the part of speech “determinative” (in their terminology) is used in the “determiner function” (cf. too Huddleston 2006: 86–87). Here, I am using the more customary and less confusing terms: *specifier* for the relation (their “determiner”), and *determiner* for a part of speech (their “determinative”). In this section, it will be discussed in detail how this relation can be described, and distinguished from arguments and adjuncts.

The second question, is more difficult to answer. As it will be shown, the specifier-head relation shares properties with the head-adjunct relation, as well as with the head-argument relation. The notion of “specifier” is normally used in the syntactic literature for elements, which are fulfilling neither the function of complements, nor of adjuncts, but are nevertheless syntactically dependent on the

[37] For a discussion, see for instance Speas (1990: 36–37), Sternefeld (2006b: 720–722), and Van Eynde (2006: 158–160).

head.[38]

In traditional $\overline{\text{X}}$-theory (cf. Chomsky 1970: 210; Jackendoff 1977: 14; Chomsky and Lasnik 1993: 527), the specifier is considered as a relation "specifier-of" – and not as a category – and is represented as a special syntactic position in a tree. The specifier position is, according to that, configurationally defined as the sister constituent of X′, but immediately dominated by XP (see the description of Figure 2.10 in Section 2.5.3). The question is, what does it mean for a linguistic object to be in a "specifier-of" relation? The answers to that question are manifold and strongly dependent on the framework and on the stage of the theory. For instance, Jackendoff (1977: 37) refers to the introduction of the specifier notion in Chomsky (1970) as follows:

> Chomsky uses the term *specifier* to refer to the material in a phrase to the left of the head, and *complement* to refer to the material to the right of the head.[39]

At this stage – the beginning of $\overline{\text{X}}$-theory – the specifier is reduced to a syntactic position. Linguistic objects which can occupy this position are determined by the head, i.e. they are dependents of the head. The elements which can occupy this position were identified in Chomsky (1970: 210) as follows:

> [. . .] [Spec, $\overline{\text{N}}$] will be analyzed as the determiner, [Spec, $\overline{\text{V}}$] as the auxiliary (perhaps with time adverbials associated), and [Spec, $\overline{\text{A}}$] perhaps

[38] Specifiers are sometimes treated as arguments, or at least as argument-like elements, as the following quote of Pollard and Sag (1994: 23) indicates:

> Here the notion *complement* is broadly construed to include not only sisters of lexical heads but also certain dependent elements classified as specifiers in GB theory (i.e. subjects, including determiner subjects of NPs).

Pollard and Sag (1994) make their distinction more fine-grained from Chapter 9 on, distinguishing between subjects, specifiers, and complements. In NPs, the elements right to the head noun are sometimes analysed as modifiers (cf. for instance, Vater 1986: 135–142 and Vater 1991: 17).

[39] Kayne (1994: 35) – at a later stage of the theory – adopts the same view regarding the position of specifier and complement with respect to the head. This position had massive influence on the cartographic approaches in MGG (cf. for instance Cinque 1999) leading to a different notion of the specifier-relation than the one assumed here. Due to space limitations, I will not discuss the cartographic approach here. See Cinque and Rizzi (2010) for an overview.

> as the system of qualifying elements associated with adjective phrases (comparative structures, *very*, etc.).[40]

That is to say – although not explicitly mentioned – at this stage of the theory, functional elements like determiners and auxiliaries were identified to occupy this position.

In *Government & Binding* (GB) (cf. Chomsky, 1981: 64–65) and in particular in *Principles and Parameters* (Chomsky and Lasnik, 1993: 528), the properties of the specifier position are described in more detail. In the latter, the specifier is considered as a generally optional position, which is target for movement, and which has no independent theta-role (Chomsky and Lasnik, 1993: 528). In the course of the GB-theory, the specifier position undergoes two major modifications with respect to the objects that occupy this position. Firstly, since Brame (1982)[41]– and even more so since the seminal work of Abney (1987) – the determiner has not been analysed as the specifier of the NP any more. Moreover, the NP was analysed as the complement of D^0 (cf. Figure 3.14). This change is due to a change in the paradigm according to which functional projections take lexical projections as their complements yielding a rethinking of phrase structures. this new structure led to the so-called DP-analysis of NPs. The second change concerns the connection of the specifier-relation with the subject-relation (see for instance Chomsky 1986: 3 and its implementation in the theory of double-object constructions in Larson 1988: 347 a.o.).[42]

These two changes were important for the theory in order to ensure the universality of the phrase structural component of the grammar, i.e. $\overline{\text{X}}$-theory, and thus the parallelism between noun phrases and sentences (as presented in Figures 3.14

[40] This fact and the later change in the specifier-relation of VPs has been mentioned in Foonote 70 on page 49 and will be addressed below again.

[41] In Lyons (1977b: 392), there is a comment against the classification of the noun as the head of the NP based on the "non-intersubstitutability" of N and NP.

[42] It is important to note that the "subject-of" and "object-of" relations in MGG are first and foremost configurationally defined relations and not primitives of the grammar (cf. Speas, 1990: 7–8). That is to say, they describe primarily positions in a tree-structure. This is best illustrated by the analysis of Larson on double object constructions. Larson's approach on sentences like (i) take the direct object *a letter* as "subject", and the indirect object *to Mary* as "object" of the innermost VP shell (cf. Larson, 1988).

(i) John send [a letter] [to Mary].

and 3.15) strengthening the structural uniformity which in many frameworks is considered as a goal of linguistic theory (cf. Culicover and Jackendoff 2005: 46–50 for a discussion on the topic of uniformity).

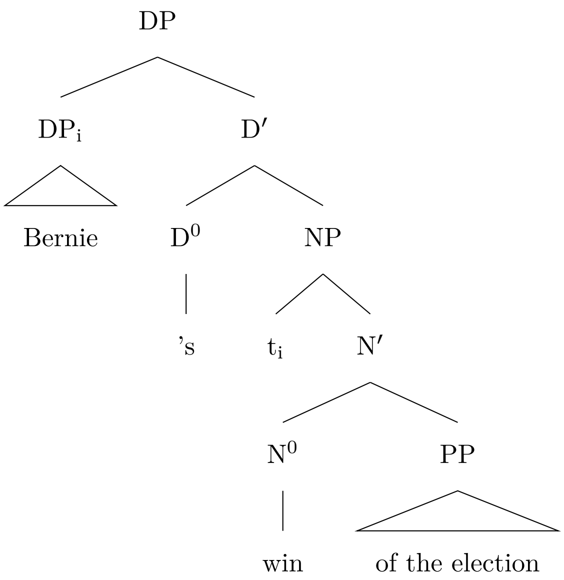

Figure 3.14: DP structure

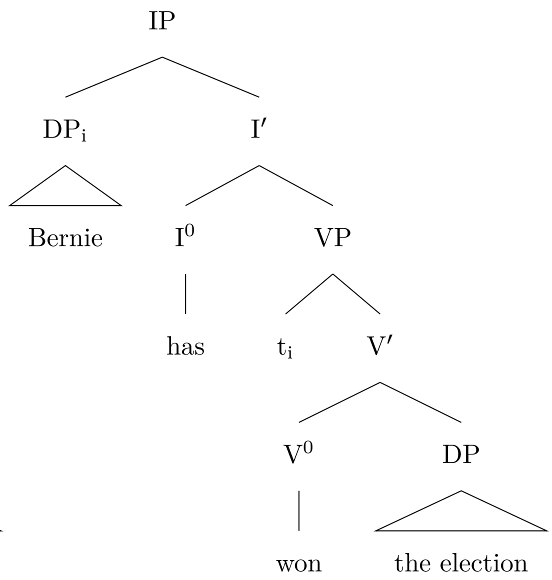

Figure 3.15: IP structure

In Figures 3.14 and 3.15, the specifier of the NP and of the VP are the positions for the base-generation of "subjects", which are moved from there (leaving a trace *t*) to the specifier position of the functional projections DP and IP, respectively.[43] The determiner *'s* in Figure 3.14[44] and the auxiliar *has* in Figure 3.15 are not treated any more – in comparison to the quote of Chomsky (1970) given above – as specifiers, but as heads. Further categories which are considered to occupy the specifier position in GB are for instance all kinds of modifiers and quantifiers (cf. Speas, 1990: 36–37).

Thus, a specifier in MGG can be considered as the all-rounder *position* in the theory. It can be used for arguments (viz. subjects), for modifiers (viz. adjuncts), and for quantifiers (which are normally considered as specifiers). Sometimes, it has a theta-role, e.g. for subjects, and sometimes it has not, e.g. for modifiers or as a landing place for movement. Furthermore, the cardinality of specifiers is strongly dependent on the stage of theory, and/or on the phrasal type (cf. Speas 1990: 37

[43]This, of course, only by assumption of VP-internal subjects (cf. Speas, 1990: 17–18).

[44]In Section 4.6, further GB approaches for pre-nominal genitives will be described and discussed.

vs. Kayne 1994: 22), and sometimes the notion of specifier as explanative notion is completely banned from the theory (cf. Sternefeld, 2006b: 722). In the remainder of the section, the notion of specifier and the relation that it represents will be described. Additionally, it will be shown, how specifiers can be analyse in HPSG.[45]

In HPSG, a specifier is regarded as well as a relation as expressed above, but in comparison to MGG approaches this relation is distinguished from subjects, and specifiers are typically not treated as heads of the nominal complex (cf. Borsley 1987b; Pollard and Sag 1994: 358–362; Müller 2013a: 82ff; a.o.).[46]

As the examples in (35) – taken from Pollard and Sag (1994: 358) – show, the specifier relation is not constrained neither for a single part of speech as *specifier*, nor for a particular kind of phrase as the *specified* object.

(35)
a. Kim saw [$_{\text{NP}}$ {*some*/*the*/*many*/*six*} unicorns].
b. John is [$_{\text{AP}}$ {*very*/*too*/*six feet*} tall].
c. Mary's office is [$_{\text{PP}}$ {*just*/*right*} around the corner].
d. [$_{\text{QP}}$ {*A dozen*/*many*} fewer] people came to the reception than had been expected.

For instance, NPs, APs, PPs, or QPs can be specified as (35a), (35b), (35c), and (35d) show, respectively. In addition, parts of speech like quantifiers and determiners (cf. (35a)), adverbs and (gradation) particles (cf. (35b) and (35c)), as well as complex NPs like *six feet* or *a dozen* (cf. (35b) and (35d)) can function as specifiers. What is more, a specifier can even contain itself a specifier, as is the case in example (35d) in which *a dozen fewer* is a specifier of *people*, while *a dozen* is a specifier to *fewer*.

In NPs, determiners are the prototypical part of speech that is used in a specifier relation with the noun.[47] Regarding selection, at least for singular count nouns in

[45] In the literature, there is much reservation about the notion of specifier. Among other things, it is unclear how complex a constituent in the specifier position can be, as well as how many specifiers are allowed, and whether it is not possible to merge the specifier relation either with the argument or the modifier relation. See for instance, Fries (1988a: 25); Allegranza (1998: 60); Van Eynde (2006).

[46] A DP-analysis of NPs in HPSG is provided in Netter (1994). See also Pollard and Sag (1987) and their comment with respect to the possessive clitic *'s* in English on page 60, and their FN 3, on page 68.

[47] Remember that in Payne and Huddleston (2002: 330) the "specifier (relation)" is called "determiner (function)".

languages like English (cf. (36a) vs. (36b)), German (cf. (37a) vs. (37b)), or Spanish (cf. (38a) vs. (38b)), noun phrases are grammatical only with a specifier.

(36) a. This book won [$_{\text{NP}}$ the prize].
b. * This book won [$_{\text{NP}}$ prize].

(37) a. Dieses Buch gewann [$_{\text{NP}}$ den Preis].
b. * Dieses Buch gewann [$_{\text{NP}}$ Preis].

(38) a. Ese libro ganó [$_{\text{NP}}$ el premio].
b. * Ese libro ganó [$_{\text{NP}}$ premio].

But, it depends on the noun if a specifier is needed or not. For instance, mass nouns or plural nouns (cf. (39)–(41)) do not *necessarily* occur with a determiner.[48] That is, the *noun* must syntactically specify if a determiner must *obligatorily* co-occur (as in examples (36)–(38)) or not (as for the plural count nouns in (39)–(41)).

(39) a. This book won [$_{\text{NP}}$ the prizes].
b. This book won [$_{\text{NP}}$ prizes].

(40) a. Dieses Buch gewann [$_{\text{NP}}$ die Preise].
b. Dieses Buch gewann [$_{\text{NP}}$ Preise].

(41) a. Ese libro ganó [$_{\text{NP}}$ los premios].
b. Ese libro ganó [$_{\text{NP}}$ premios].

While Pollard and Sag (1987: 118–119) argue for a treatment of determiners as elements of the SUBCAT list, which includes *all* arguments of a head (i.e. subject and complements), in subsequent work in HPSG, the determiner (more precisely: specifiers in general) was separated from other arguments of a head (cf. Borsley 1987b; Pollard and Sag 1994: 358–362; Müller 1999: 58–61; Przepiórkowski 1999: 18–19; a.o.).

As mentioned in Section 2.5.3, the specifier is selected by the noun through the SPR feature which – in addition to SUBJ and COMPS – belongs to the set of VAL features. But, in comparison to subjects or complements, the determiner is not a semantic argument of the noun, i.e. it does not get a theta-role from the noun. On the contrary, the semantics of the noun is restricted, or *specified*, by the determiner.

[48] For a semantic analysis of common and mass nouns see Krifka (1995a). His analysis focuses on English and Chinese NPs from a semantic perspective.

For instance, taking examples (42a) and (42b), the meaning of the whole NP varies according to the meaning of the determiners.

(42) a. [$_{\text{NP}}$ The tie] is black.

b. [$_{\text{NP}}$ Every tie] is black.

Assuming that the meaning of *tie* is the set of entities which are ties (cf. (43a)), the NP in (42a) denotes a unique element in the (relevant) world which is a tie,[49] while the NP in (42b) denotes a relation between the entities which are ties and the property to be black, namely the set of entities which are ties, is a subset of the set of entities that are black (cf. Barwise and Cooper, 1981: 165).

To see how the determiner incorporates the semantics of the noun, let us look at the standard semantic treatment for determiner-noun combinations (cf. Heim and Kratzer 1998, a.o.). The denotations for the predicates *tie* and *is black*, for the definite determiner *the*, and for the quantifier *every* are given in (43). According to that, the denotation of *tie* – as given in example (21b) above and repeated here as (43a) – is a predicate of type $\langle e,t\rangle$, and can be paraphrased as the set of entities which are ties. The denotation of *is black* is also of type $\langle e,t\rangle$, and can be paraphrased as the set of entities which are black (cf. (43b)). The definite determiner *the* is of type $\langle\langle e,t\rangle,\langle e\rangle\rangle$, i.e. *the* takes a predicate (type $\langle e,t\rangle$) and gives a unique entity (type $\langle e\rangle$) as a result (cf. (43c)). The semantics of the quantifier *every* is more complicated. *every* is of type $\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle$. It takes two predicates (type $\langle e,t\rangle$) – e.g. the noun *tie* and the VP *is black* – and gives a truth-value as a result (cf. (43d)).

(43) a. $[\![\textit{tie}]\!]_{\langle e,t\rangle} :=$
$\lambda x \in \mathrm{D}_e \,.\, x \text{ is a tie}$

b. $[\![\textit{is black}]\!]_{\langle e,t\rangle} :=$
$\lambda x \in \mathrm{D}_e \,.\, x \text{ is black}$

c. $[\![\textit{the}]\!]_{\langle\langle e,t\rangle,\langle e\rangle\rangle} :=$
$\lambda f \in \mathrm{D}_{\langle e,t\rangle} \;\&\; \exists! x[f(x) = 1] \,.\, \iota y[f(y) = 1]$

d. $[\![\textit{every}]\!]_{\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle} :=$
$\lambda f \in \mathrm{D}_{\langle e,t\rangle} \,.\, [\lambda g \in \mathrm{D}_{\langle e,t\rangle} \,.\, \forall x[f(x) = 1 \rightarrow g(x) = 1]]$

[49] I am not going to discuss the properties related to the term *definiteness*, so for instance, familiarity (cf. Heim, 1988: 298–302) or uniqueness (cf. Russell, 1905: 481–483). The interested reader is referred to Lyons (1999: 253–281) for a general overview.

According to the types of the determiners and of the noun, they can be combined by virtue of Functional Application. Thereby, the noun is treated in both combinations (cf. (44) and (45)) as the argument of the determiner, with the semantics of the noun being incorporated into the denotation of the determiner.

(44) $[\![\textit{the tie}]\!] \equiv [\![\textit{the}]\!]([\![\textit{tie}]\!])$
$\equiv [\lambda f \in \mathrm{D}_{\langle e,t\rangle} \ \&\ \exists! x[f(x) = 1] \ .\ \iota y[f(y) = 1]]([\lambda x \in \mathrm{D}_e \ .\ x \text{ is a tie}])$
$\equiv \exists! x[\lambda x' \in \mathrm{D}_e \ .\ x' \text{ is a tie}](x) = 1 \ .\ \iota y[\lambda x \in \mathrm{D}_e \ .\ x \text{ is a tie}](y) = 1$
$\equiv \exists! x[x \text{ is a tie} = 1] \ .\ \iota y[y \text{ is a tie} = 1]$

(45) $[\![\textit{every tie}]\!] \equiv [\![\textit{every}]\!]([\![\textit{tie}]\!])$
$\equiv [\lambda f \in \mathrm{D}_{\langle e,t\rangle}.[\lambda g \in \mathrm{D}_{\langle e,t\rangle}.\forall x[f(x) = 1 \rightarrow g(x) = 1]]]([\lambda x \in \mathrm{D}_e.x \text{ is a tie}])$
$\equiv \lambda g \in \mathrm{D}_{\langle e,t\rangle}.\forall x[[\lambda x' \in \mathrm{D}_e.x' \text{ is a tie}](x) = 1 \rightarrow g(x) = 1]$
$\equiv \lambda g \in \mathrm{D}_{\langle e,t\rangle}.\forall x[x \text{ is a tie} = 1 \rightarrow g(x) = 1]$

As a result, the denotation of *the tie* as presented in (44) can be paraphrased as "the exactly one entity, which is unique and for which it holds that it is a tie". In comparison, the denotation of *every tie* as presented in (45) is incomplete, since it is looking for a predicate g of type $\langle e, t\rangle$ (e.g. *is black*, cf. (43b)). But including this predicate, the result can be paraphrased as "for all entities x, it holds that if they are ties, then they are black." Loosely speaking, the denotation of the noun, which is exactly the same in both cases, varies from a unique tie to the entire set of ties (cf. examples (42a) and (42b)).

Therefore – similar to the head-adjunct relation – in the specifier-head relation the semantics of the noun must be incorporated in the semantics of the specifier. But – unlike the head-adjunct relation and similar to the head-argument relation – the noun determines if a specifier is needed or not. Hence, in a head-specifier relation, we are dealing with a mutual selection (cf. Pollard and Sag, 1994: 50), the noun selects syntactically the determiner, and the determiner selects semantically the noun. In the following sections, it will be shown how HPSG accounts for the combination of heads and specifiers. Firstly, the specifications at lexical level will be provided in Section 3.3.1, that is, it will be discussed how the feature geometry of signs has been adapted in order to account for head-specifier combinations. Secondly, in Section 3.3.2, the grammar rules which license the head-specifier combination and the adequate constituent order between both will be presented.

3.3.1 Lexical specifications

As mentioned in the previous section, the relation between a head and a specifier is a mutual selection. On the syntactic side, it is similar to the head-argument relation, i.e. the head selects the specifier. On the semantic side, it is similar to the head-adjunct relation, i.e. the specifier selects the head. For this mutual selection two attributes are used: SPECIFIER (SPR) and SPECIFIED (SPEC), such that

- the noun selects the determiner through its VAL|SPR attribute, and
- the determiner select the noun through its HEAD|SPEC attribute.

The SPR attribute is – like SUBJ and COMPS – a *list* (of *synsem*) valued VAL attribute of the noun which constrains for syntactic reasons – viz. agreement and valence saturation – the description of its specifier, as given below (cf. too the lexical entry for *Krawatte* 'tie' in (46)):

1. the noun selects a DP, i.e. a determiner whose VAL lists are empty;[50] and
2. the CASE, NUM, and GEND values of the determiner must be token identical with the CASE, NUM, and GEND values of the noun.

The SPEC attribute of the determiner is – like MOD for adjuncts – a *synsem* valued HEAD attribute.[51] It is through SPEC that the determiner gets access to the noun's variable IND which has to be specified for semantic reasons. Therefore, the constraining of the determiner is accomplished as given below (cf. too the lexical entry for the German definite determiner *die* 'the' in (47)):

1. the determiner selects an N′, i.e. a noun whose SUBJ and COMPS lists are empty, but whose SPR list is not; and
2. the IND value of the noun must be token identical with the value of the RELS|ARGUMENT (ARG) value of the determiner.

Furthermore, for determiners, the CASE, PER, NUM, and GEND attributes are HEAD attributes. I am expanding here an account for agreement made in Müller (2013a: 217), and proposing that not only CASE and GEND, but also PER and NUM

[50]This is important since by virtue of the ValP only the valence features of the head are projected.

[51]For elements which cannot be used as specifiers, the value of SPEC is *none*.

(46)
$$\begin{bmatrix} \text{PHON} & \langle \textit{Krawatte} \rangle \\ \text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{CASE} & \boxed{1}\ \textit{nom} \\ \textit{noun} & \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \left\langle \text{DP} \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{CASE} & \boxed{1} \\ \text{NUM} & \boxed{2} \\ \text{GEND} & \boxed{3} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{4} \begin{bmatrix} \text{PER} & \mathit{3} \\ \text{NUM} & \boxed{2}\ \textit{sg} \\ \text{GEND} & \boxed{3}\ \textit{fem} \\ \textit{ref} & \end{bmatrix} \\ \text{RELS} & \left\langle \begin{bmatrix} \text{INST} & \boxed{4} \\ \textit{tie} & \end{bmatrix} \right\rangle \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\ \textit{word} & \end{bmatrix}$$

(47)
$$\begin{bmatrix} \text{PHON} & \langle \textit{die} \rangle \\ \text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{CASE} & \textit{nom} \\ \text{PER} & \boxed{2}\ \mathit{3} \\ \text{NUM} & \boxed{3}\ \textit{sg} \\ \text{GEND} & \boxed{4}\ \textit{fem} \\ \text{SPEC} & \text{N}'_{\boxed{1}} \\ \textit{det} & \end{bmatrix} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{1} \begin{bmatrix} \text{PER} & \boxed{2} \\ \text{NUM} & \boxed{3} \\ \text{GEND} & \boxed{4} \\ \textit{ref} & \end{bmatrix} \\ \text{RELS} & \left\langle \begin{bmatrix} \text{INST} & \boxed{1} \\ \textit{def} & \end{bmatrix} \right\rangle \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\ \textit{word} & \end{bmatrix}$$

are included into the HEAD attributes.[52] For determiners like *die* 'the.F.SG', the PER, NUM, and GEND values are structure-shared with its values in IND (cf. $\boxed{2}$, $\boxed{3}$, and $\boxed{4}$ in (47)). But, for instance for possessive determiners like *sein* 'his' and *mein* 'my' in example (48), the values in IND are different from the values in HEAD.

(48) a.

Er	hat	sein-e	Taschen	vergessen.
he	has	his.3.SG.M-3.PL.F	bags.3.PL.F	forgotten

'He has forgotten his bags.'

b.

Ich	habe	mein-e	Schlüssel	vergessen.
I	have	my.1.SG-3.PL.M	keys.3.PL.M	forgotten

'I have forgotten my keys.'

In example (48a), the determiner is a 3rd person, singular, masculine object *sein* 'his', and these are its values in IND, but it is the specifier of a 3rd person, plural, feminine object *Taschen* 'bags'. That is, we have here a mismatch in number and gender. Example (48b) shows further a mismatch in person and number. Therefore, at least for possessives the HEAD values of the PER, NUM, and GEND attributes must not coincide with their counterparts in IND.

3.3.2 Head-Specifier combination in HPSG

Now that the lexical entries of determiners and nouns have been clarified with respect to the attributes needed for the head-specifier combination, it is also necessary to examine the phrase structural constraints which license grammatical combinations of heads and specifiers.

First, in order to ensure that the SPEC value of a specifier, which is a non-head daughter, is identified with the value of the head daughter, a principle called Specified Principle (SPECP) is needed (cf. Pollard and Sag 1994: 50; Müller 2013a: 83; a.o.).

(49) Specified Principle (SPECP)
If a non-head daughter in a headed structure bears a SPEC value different from *none*, it is token-identical to the SYNSEM value of the head daughter.

Thus, the SPECP can be formulated in form of an implicational constraint applying only to elements of type *headed-structure*, and by virtue of the inheritance ontology

[52] The reasons for this expansion will be clarified in detail in Section 4.6.

given in HPSG, also on its subtypes. As mentioned in (49), the value of the non-head daughter's SPEC attribute should be different from *none*, this is stated in the constraint with the negation symbol (¬), as (50) shows.

(50) Specified Principle (SPECP)

$$\textit{headed-structure} \rightarrow \begin{bmatrix} \text{HD-DTR}|\text{SYNSEM } \boxed{1} \\ \text{NH-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{HEAD}|\text{SPEC } \boxed{1} \end{bmatrix} \wedge \boxed{1} = \neg\ \textit{none}$$

For the combination of a specifier with a head, in order to build a phrase of type *head-specifier-structure*, the Head-Specifier Schema (cf. Section 2.5.3) constrains that the SYNSEM value of the non-head daughter must be identified with the one element[53] of the SPR list of the head daughter. The SPR value of the phrase is, thus, the value of the SPR list of the head minus the SYNSEM value of the non-head daughter (cf. (51)).

(51) ID-schema 2: Head-Specifier Schema

$$\textit{head-specifier-structure} \rightarrow \begin{bmatrix} \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL}|\text{SPR } \boxed{1} \\ \text{HD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VAL} \begin{bmatrix} \text{SPR } \boxed{1} \oplus \left\langle \boxed{2} \right\rangle \\ \text{COMPS } \langle\ \rangle \end{bmatrix} \\ \text{NH-DTR}|\text{SYNSEM } \boxed{2} \end{bmatrix}$$

Furthermore, the Head-Specifier Schema constrains that the COMPS list of the head must be empty, such that the specifier is the last valence element which combines with the head, as it is shown in Figure 3.16.[54]

The linearity conditions for head-specifier combinations were discussed in detail in Section 2.5.4. Hence, I am just going to repeat the involved LP-rule for the sake of completeness. The rule in (52), and more precisely its formulation in (53), constrains that the PHON value of the non-head daughter, i.e. the specifier, is placed *before* the PHON value of the head daughter.

[53]This holds, of course, for languages which have *only one* specifier. In these cases, the list of the specifier has been proposed to be a singleton (cf. Przepiórkowski, 1999: 18). For languages, for which it is assumed to have more than one specifier (normally more than one determiner), e.g. Greek, Scandinavian, Romanian (cf. Alexiadou, 2014), the SPR list can be discharged recursively.

[54]See Section 2.5.3 for a discussion on this topic.

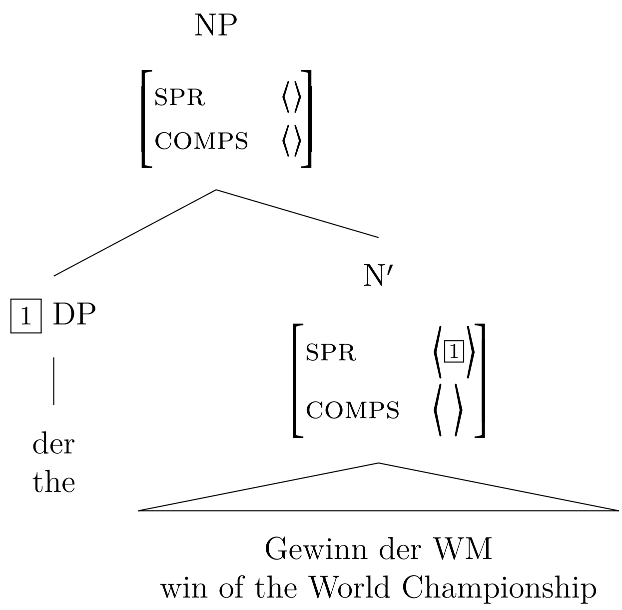

Figure 3.16: Head-specifier structure

(52) LP-rule 2: Head – Specifier
specifier < head

(53) Specifier < Head

$$\left[\begin{array}{l} \text{PHON } \boxed{4} \oplus \boxed{3} \\ \text{SYNSEM|LOC|CAT|VAL|SPR } \boxed{1} \\ \text{HD-DTR} \left[\begin{array}{l} \text{PHON } \boxed{3} \\ \text{SYNSEM|LOC|CAT|VAL} \left[\begin{array}{l} \text{SPR } \boxed{1} \oplus \langle \boxed{2} \rangle \\ \text{COMPS } \langle\ \rangle \end{array}\right] \end{array}\right] \\ \text{NH-DTR} \left[\begin{array}{l} \text{PHON } \boxed{4} \\ \text{SYNSEM } \boxed{2} \end{array}\right] \end{array}\right]$$

Three further principles which have to be mentioned are the HFP, the ValP (cf. (48) and (50), respectively, in Section 2.5.5), and the SemP (cf. (34) in Section 3.2.3.3). For the HFP, since the *head-specifier-structure* is a subtype of *headed-structure*, it holds that the HEAD value of the head-daughter is projected to the phrase. According to the ValP, the VAL values of the head daughter are projected to the phrase.

The SemP as formulated in (34) in Section 3.2.3.3 offers two possibilities to account for the head-specifier combination in accordance to the type hierarchy in Figure 3.8 (cf. Section 3.1.4).

- Firstly, it would be possible to treat specifiers like arguments and expand the first clause of the SemP to the type *head-non-adjunct-structure* (cf. (54a) below).
- Secondly, we could treat specifiers like adjuncts and expand the second clause of the SemP to the type *head-non-argument-structure* (cf. (54b) below).

The first solution fails since the denotation of nouns must be included into the denotation of its determiner. This was shown with respect to examples (44) and (45) in Section 3.3. The noun, thus, must be interpreted in the scope of the determiner and the plain concatenation of RELS would not yield this as a result. The second proposal also fails. This is due to the IND value of the specifier. As was explained in Section 3.3.1 with respect to example (48), possessive pronouns have an IND value which is not structure-shared with the noun. Therefore, it is not possible to project the complete CONT value of the specifier. As these two proposals fail to account for the semantic composition of head-specifier combinations, I am arguing that a third clause needs to be added to the SemP in order to account for these facts (cf. (54c)): The structure sharing of the CONT value is divided into two parts, the IND value is projected from the head daughter, and the RELS value is projected from the non-head daughter.

(54) Semantic Principle (SemP) (4$^{\text{th}}$ preliminary version)
For phrases of type *headed-structure*,

a. if the headed phrase is of type *head-argument-structure*:
   i. its CONT|IND value is structure-shared with the CONT|IND value of the head daughter and,
   ii. its CONT|RELS value is the concatenation of the RELS lists of the head daughter and the non-head daughter;
b. if the headed phrase is of type *head-adjunct-structure*:
   i. its CONT value is structure-shared with the CONT value of the non-head daughter.
c. if the headed phrase is of type *head-specifier-structure*:

i. its CONT|IND value is structure-shared with the CONT|IND value of the head daughter and,

ii. its CONT|RELS value is structure-shared with the CONT|RELS value of the non-head daughter.

(55) Semantic Principle (SemP) (4th preliminary version)

$$
\textit{headed-structure} \rightarrow
\left[\begin{array}{l}
\text{SYNSEM|LOC|CONT} \left[\begin{array}{l} \text{IND } \boxed{1} \\ \text{RELS } \boxed{2} \oplus \boxed{3} \end{array}\right] \\
\text{HD-DTR|SYNSEM|LOC|CONT} \left[\begin{array}{l} \text{IND } \boxed{1} \\ \text{RELS } \boxed{2} \end{array}\right] \\
\text{NH-DTR|SYNSEM|LOC|CONT} \left[\begin{array}{l} \text{RELS } \boxed{3} \end{array}\right] \\
\textit{head-argument-structure}
\end{array}\right]
$$

$$
\vee
\left[\begin{array}{l}
\text{SYNSEM|LOC|CONT } \boxed{1} \\
\text{NH-DTR|SYNSEM|LOC|CONT } \boxed{1} \\
\textit{head-adjunct-structure}
\end{array}\right]
$$

$$
\vee
\left[\begin{array}{l}
\text{SYNSEM|LOC|CONT} \left[\begin{array}{l} \text{IND } \boxed{1} \\ \text{RELS } \boxed{2} \end{array}\right] \\
\text{HD-DTR|SYNSEM|LOC|CONT} \left[\begin{array}{l} \text{IND } \boxed{1} \end{array}\right] \\
\text{NH-DTR|SYNSEM|LOC|CONT} \left[\begin{array}{l} \text{RELS } \boxed{2} \end{array}\right] \\
\textit{head-specifier-structure}
\end{array}\right]
$$

Thus, summarising the notion of specifier with Figure 3.17, as has been done for the head, arguments and adjuncts, it can be said that the head-specifier relation is also a horizontal relation in which the head determines by virtue of the HFP the morphosyntactic properties of the phrase. In comparison to the head-argument and the head-adjunct relations, the head-specifier relation represents a mutual selection in which the head selects the specifier (through the SPR attribute), and the specifier the head (through the SPEC attribute). Moreover, the semantics of the head is restricted by the specifier by incorporating the IND and RELS value of the head into the RELS list of the specifier. The semantics of the phrase follows straightforwardly from the new clause of the SemP, the IND value of the phrase is structure shared with the one of the head, and the RELS list of the phrase is structure shared with the one of the specifier.

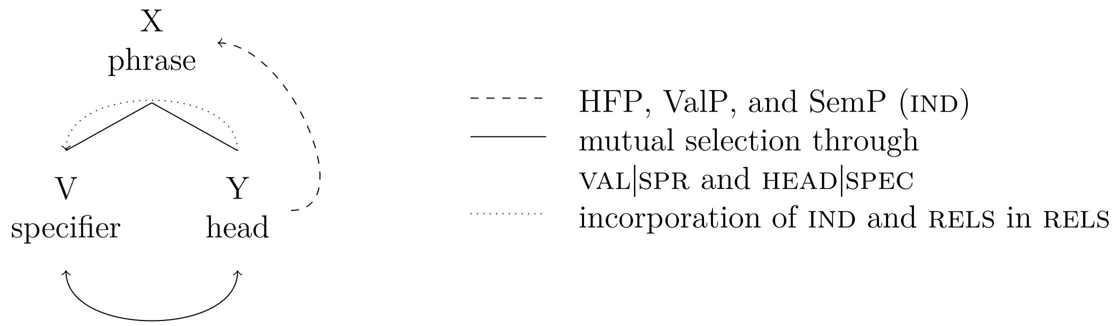

Figure 3.17: Head-specifier relation

3.4 Summary: Head, Argument, Adjunct, and Specifier

Now, that the single notions of head, argument, adjunct, and specifier have been clarified, a direct comparison of these notions by means of HPSG can be made.

The first comparison is to be made with respect to the main properties *determined by the head daughter* in a structure:

1. The value of the HEAD attribute is always determined by the head daughter.
2. The value of the VAL attributes is always determined by the head daughter.
3. The value of IND of the structure is always the same as the IND value of the head (cf. item 8 below).

The second comparison will be concerned with the *syntactic selection* in the combination of two objects:

4. Arguments and specifiers are syntactically selected by the head.
5. Heads are syntactically selected by adjuncts and by specifiers.

And finally, a comparison will be made with respect to the *semantic selection* when combining two objects:

6. Arguments are interpreted according to the semantic restrictions of the head.
7. Heads are interpreted according to the semantic restrictions of the adjuncts and specifiers.
8. Further, the value of IND of the structure is always the same as the IND value of the head, although by a head-adjunct combination, it is the IND value of the adjunct which is projected.

With this comparison, it becomes clear that although the idea of semantic and syntactic arguments do not necessarily overlap (cf. 4–5 vs. 6–7), certain properties of the phrase (cf. 1–3) are, in every case, determined by one specific element: the head. Furthermore, this comparison shows, that specifiers can not be treated neither as arguments, nor as adjuncts, but that they represent a special case of relation to the structural head.

One last remark: Until now, I have been avoiding the term *phrase*. A phrase is, as it is used in this work, a maximal projection of a head. That is to say, a sign in which all VAL attributes are saturated. Taking this notion of *phrase*, I use the types *head-argument-"structure"* or *head-complement-"structure"* (and not *head-complement-"phrase"*), since concatenations of two elements are always structures, but not necessarily *phrases* in the sense just stated.

4 Complementation in NPs

In the last Chapter 3, the terms *head*, *argument*, *adjunct*, and *specifier* were discussed and the distinction between these notions was semantically and syntactically motivated. The lexical properties of the elements (i.e. their attribute-value pairs) and the structural properties of the combinations (e.g. ID-schemata, principles, etc.) served as the basis for the definition and distinction of the (head-of, argument-of, adjunct-of, and specifier-of) relations. The present chapter will look at the argument-of relation – which in this chapter is named *complementation* – in more detail. Despite the name *complementation*, this chapter will not only refer to elements in the COMPS list of an NP sign. Moreover, I am introducing here the term *complementation* as a sub-term of *saturation*. Saturation is known as the operation by which the argument positions of predicates are filled and consequently are no longer available for further compositions (cf. Chung and Ladusaw, 2004: 2–4). Since it is possible to think of arguments as well as of adjuncts as elements which occupy a (semantic or syntactic) argument position, both can be treated as *saturating* elements. I take *complementation* to be the operation of saturating the *argument* positions of a head, i.e. the lists of the SUBJ and COMPS of the head, in order to make the predicate represented by the head *more complete*. I am not saying *complete* but *more complete*, since predicates (e.g. nouns) sometimes obligatorily demand specifiers. Thus, the predicate represented by the noun would not be "complete" until *specification* has taken place. Therefore, the term *complementation* contrasts with the terms *specification* and *modification*, which I will not treat at length here.[1] Flickinger (1987: 21–48) also uses the term *complementation*, but in contrast to the definition proposed here, he subsumes complementation, specification, and some cases of modification (cf. Flickinger, 1987: 71) under his terminology. Complementation, as that term is used here, implies the saturation

[1] In Section 4.6, it will be shown how in some constructions – in this case pre-nominal genitives – both complementation and specification can take place.

of arguments from a syntactic and a semantic perspective of the operation.[2]

The specific phenomena of complementation to be analysed, will be presented in detail in Section 4.1 and involves the descriptive devices needed in order to explain

- morphological and syntactic case marking,
- the realisation of post-nominal NP arguments in NPs,
- the optionality of arguments,
- the realisation of pre-nominal NP arguments, and
- the constituent order within NPs.

These phenomena will be contrastively exemplified in Spanish and German for two reasons. Firstly, they belong to different language families (viz. Romance and Germanic), and secondly, they exhibit a very different NP structure and complexity.

In Section 3.2.2, the combination of a head with its arguments was explained with stronger focus on VPs, due to the fact that the argument structure of verbs is more perspicuous as the one of nouns. At least with respect to regular nouns the status of arguments is controversial, but not so much in terms of deverbal nouns which in many cases inherit the argument structure of their verbal roots. Therefore, the phenomena in the following sections will be exemplified by means of verb nominalisations. The head-argument relation of nominal and verbal heads can be considered parallel, but some differences need to be accounted for. The verb nominalisation with *-ung* in German and with *-miento* in Spanish '-ment' will help us to work out the differences between VPs and NPs with respect to their combination with arguments.[3] In Section 4.2, a general principle of case assignment in HPSG will be outlined.[4] In Section 4.3, this principle will be applied to NPs, but first, a lexical rule for event nominalisation will be proposed (compare Section 4.3.1). With this lexical rule, it will be explained how (many) arguments

[2]See for instance Chung and Ladusaw (2004: 6–10) for the terms *syntactic* and *semantic saturation*, and Jacobs (1994a: 287–288) for *syntactic* and *semantic valence*.

[3]In Section 4.5, infinitive nominalisations will be used to exemplify some aspects of optionality within NPs.

[4]The Case Principle in HPSG (CaseP) should not be taken as a "universal principle". It is "general" to the extent that case assignment in many (but not necessarily *all*) languages can be accounted for with it.

can be realised canonically inside the NP and how the syntax-semantics linking works. Thereafter, in Sections 4.3.2–4.3.4, the distinction between German case marking and Spanish case marking and their relation to the general case principle will be worked out. Subsequently, in Section 4.4 the disparities with respect to the optionality of arguments in NPs (but not necessarily in VPs) will be discussed, and the apparatus to describe this optionality will be given.

4.1 Phenomena

In this section regularities inside German and Spanish NPs with respect to complementation will be illustrated. Based on these regularities an account an account for them will be offered. In order to have two possible arguments, i.e. (a kind of) "subject" and (a kind of) "object", I am using the event nominalisation *Behandlung* and *tratamiento* of the transitive verbs *behandeln* in German and its Spanish counterpart *tratar* '(to) treat'. With the following examples, I will show which combinations are possible in German and Spanish NPs.[5]

By means of the event nominalisation through *-ung* in German and *-miento* in Spanish, the argument structure of the verbs with their argument linking to their respective theta-roles seems not to change (cf. (1a) and (2a)). Both, the "subject" (cf. (1b) and (2b)) as well as the "object" (cf. (1c) and (2c)) of the verbal head can be realised in the nominal structure. But the case assignment must change from nominative/accusative in the sentence (cf. (1a) and (2a)) to genitive in the NPs.[6]

(1) a. Der Arzt behandelt den Patienten.
the.NOM doctor.NOM treats the.ACC patient.ACC
'The doctor treats the patient.'

b. die Behandlung des Arztes
the treatment the.GEN doctor.GEN
'the treatment of the doctor'

c. die Behandlung des Patienten
the treatment the.GEN patient.GEN
'the treatment of the patient'

[5]The event nominalisation by means of the affixes *-ung* in German and *-miento* in Spanish can have different semantic properties. See for instance Bierwisch (1989) and Dölling (2015) for the German nominalisation and Fábregas (2010) for the Spanish one.

[6]The examples (1), (3b), (5a), and (5b) are taken from Reis (1976: 32–33).

(2) a. El doctor trata a-l paciente.
the.NOM doctor.NOM treats to-the.ACC patient.ACC
'The doctor treats the patient.'

b. el tratamiento de-l doctor
the treatment of-the.GEN doctor
'the treatment of the doctor'

c. el tratamiento de-l paciente
the treatment of-the.GEN patient
'the treatment of the patient'

Although, both arguments can be realised as the examples (1)–(2) show, it is not possible to realise them both in genitive at the same time (cf. (3b) and (4b)), while it is possible to drop them all, since all arguments of NPs are optional (cf. (3a) and (4a)) in contrast to arguments of VPs which are sometimes obligatory.

(3) a. die Behandlung
the treatment
'the treatment'

b. * die Behandlung [des Arztes] [des Patienten]
the treatment the.GEN doctor.GEN the.GEN patient.GEN
'the treatment of the patient by the doctor' [intended reading]

(4) a. el tratamiento
the treatment
'the treatment'

b. * el tratamiento [de-l doctor] [de-l paciente]
the treatment of-the.GEN doctor of-the.GEN patient
'the treatment of the patient by the doctor' [intended reading]

Although the two arguments cannot be realised after the head at the same time (as genitive NPs), there is not a general impossibility to realise two post-nominal genitives in a row after the head as (5a) and (6a) show. The difference between (3b) and (4b) on the one hand, and (5a) and (6a) on the other hand, is that for the intended reading in (3b) and (4b) both genitive NPs must be single arguments of the head *Behandlung/tratamiento* 'treatment', while for the intended reading in (5a) and (6a), there is only a single NP that is the argument of the head (*Abschluss/fin* 'end'). This single NP, however, is complex with *Behandlung/tratamiento* 'treatment' being the head, and *des Patienten/del paciente* 'of the patient' being its argument.[7]

(5) a. der Abschluss [der Behandlung [des Patienten]]
the end the.GEN treatment.GEN the.GEN patient.GEN
'the end of the treatment of the patient'

b. die Behandlung [des Patienten] [durch den Arzt]
the treatment the.GEN patient.GEN through the.ACC doctor.ACC
'the treatment of the patient by the doctor'

(6) a. el fin [de-l tratamiento [de-l paciente]]
the end of-the.GEN treatment of-the.GEN patient
'the end of the treatment of the patient'

b. el tratamiento [de-l paciente] [por medio de-l doctor]
the treatment of-the.GEN patient through of-the doctor
'the treatment of the patient by the doctor'

That is to say, we are not dealing with ungrammaticality due to matters of "style" in the sense of Behaghel's *Gesetz der wachsenden Glieder* 'law of the growing members' (cf. Behaghel, 1909: 139), but we are dealing with a *structural* problem (cf. Reis 1976: 70; Sternefeld 2006a: 213–217; a.o.) since the realisation of one argument bans the realisation of the other.[8] Furthermore, similar to the verbal passive, the "subject" or the "agent argument" can be realised as a PP inside

[7]Since examples (3b) and (4b) could also get the reading: 'the treatment of someone who is the doctor of the patient' (parallel to examples (5a) and (6a)), I always give the *intended readings*. The examples are thus ungrammatical with respect to the intended readings, since the structures which reflect this meaning cannot be built.

[8]Sternefeld (2006a: 216–217) gives (i) a.o. as a "pretended counterexample" to the assumption that in German only one genitive phrase can follow its head noun. Since *The Phantom of Liberty* is the name of a film by Luis Buñuel, Bücking (2012: 25) proposes that the complex NP *das Gespenst der Freiheit* should be re-analysed as a (complex) head noun, licensing one single genitive phrase for the possessor (cf. Hartmann and Zimmermann 2003 for further examples with two genitives). As example (ii) shows, the alleged counterexample works in Spanish in the same manner.

(i) das Gespenst [der Freiheit] [des Luis Buñuel]
the phantom the.GEN liberty the.GEN Luis Buñuel

(ii) el fantasma [de la libertad] [de Luis Buñuel]
the phantom of the liberty of Luis Buñuel
'The Phantom of Liberty of Luis Buñuel'

the NP, in German the preposition *durch* is used (cf. (5b)), and in Spanish the (complex) preposition *por medio de* 'through' (cf. (6b)).

Furthermore, the ordering of post-nominal arguments and adjuncts with respect to the nominal head is the same in German (cf. (7)) and in Spanish (cf. (8)). Arguments must be adjacent to the head (cf. (7a) and (8a)), and cannot be separated from it by adjuncts as this would lead to ungrammaticality[9] (cf. (7b) and (8b)).[10]

(7) a. die Behandlung [des Patienten] [mit Tabletten]
the treatment the.GEN patient.GEN with pills
'the treatment of the patient with pills'

b. * die Behandlung [mit Tabletten] [des Patienten]
the treatment with pills the.GEN patient.GEN
'the treatment of the patient with pills' [intended reading]

(8) a. el tratamiento [de-l paciente] [con pastillas]
the treatment of-the.GEN patient.GEN with pills
'the treatment of the patient with pills'

b. * el tratamiento [con pastillas] [de-l paciente]
the treatment with pills of-the.GEN patient.GEN
'the treatment of the patient with pills' [intended reading]

There are two main differences between German and Spanish with respect to complementation. Firstly, German NPs are mainly morphologically case marked as the examples in (1) show. In Table 4.1 the nouns *Arzt* 'doctor' and *Patient* 'patient' with their respective determiners *der* 'the', and the pronoun *er* 'he' are given. The table shows how nouns, determiner, and pronoun can vary *morphologically* according to their case.

Spanish nouns, however, do not seem to vary according to case (cf. example (2)). In Table 4.2, the noun *doctor* 'doctor' with its determiner *el* 'the' and the free pronoun *él* 'he' with its respective clitic counterpart are given.
The table shows that the noun does not vary morphologically according to case. Moreover, case is *syntactically* marked with the dummy prepositions *a* 'to' for

[9] See also Sternefeld (2006a: 213–217) for an MGG analysis of that which rests upon the configurational assumption that complement features cannot project on the left branch of a tree.

[10] Examples (7b) and (8b) could be uttered with the genitive NP as a kind of addendum. I am not going to discuss these cases, since they are extrapositions which require further information-structural context and a specific kind of intonation, probably also a pause between the PP and the NP.

	Arzt: sg, m		Patient: sg, m		er: sg, m
nom	der	Arzt	der	Patient	er
acc	den	Arzt	den	Patient-en	ihn
dat	dem	Arzt	dem	Patient-en	ihm
gen	des	Arzt-es	des	Patient-en	seiner

Table 4.1: Case variation by noun, determiner, and pronoun (German)

	doctor: sg, m	
nom	el	doctor
acc	a-l	doctor
dat	a-l	doctor
gen	de-l	doctor

	él: sg, m		cl: sg, m
nom		él	∅
acc	a	él	lo
dat	a	él	le
gen	de	él	∅

Table 4.2: Case variation by noun, determiner, and pronoun (Spanish)

accusative and dative, and *de* 'of' for genitive. The determiners are *not* inflected for case, although it looks like that. The dummy prepositions are rather phonetically amalgamated with the determiner, i.e. $a + el = al$, and $de + el = del$. That is to say, neither the noun nor the determiner is inflected for case, but syntactically marked. With respect to the pronouns, there are two classes in Spanish: the so-called *free pronouns* and the *clitic pronouns*.[11] The same syntactic case markers (*a* and *de*) appear with free pronouns but without amalgamation, since they are normally used in contexts in which they are accented. On the other hand, the clitics in Spanish show a *morphological* variation according to case, but there are only clitics for accusative and dative.

That is to say, in German, case is mainly *morphologically* marked, and all elements inside the NP must agree in case, while Spanish NPs are mainly (with the exception of pronouns) *syntactically* case marked by virtue of dummy prepositions.

A further distinction between German and Spanish concerns the pre-nominal position, as shown in (9).

(9) a. Peters Behandlung
Peter's.gen treatment
'Peter's treatment' (Peter can be the doctor or the patient)

[11]The class of free pronouns is sometimes called *pronombres tónicos* 'accented pronouns', and the clitics *pronombres átonos* 'not-accented pronouns'. I will not elaborate the distinction between these two classes since they are irrelevant for NPs. For an overview, see Green (1988: 107–111). For an HPSG treatment of these classes of pronouns, see e.g. Van Eynde (1999).

b. * (de) Pedro tratamiento
of Pedro treatment
'Peter's treatment' [intended reading]

In German, one of the arguments can be realised pre-nominally. The pre-nominal NP can be interpreted as agent or as theme of the event (cf. (9a)).[12] But in Spanish the arguments of the noun must strictly follow the head noun (cf. (9b)).[13]

As it was shown, there are many similarities between German and Spanish NPs with respect to complementation, but also some differences. In the following sections, the analyses of these phenomena will be given concentrating on the following questions:

1. Which mechanism is needed to account for case assignment? (Section 4.2)
2. How can we deal with optionality in NPs? (Section 4.4)
3. How is it possible to constraint the maximal number of genitive arguments after the head to only one? (Section 4.3.1.2)
4. How can we account for the constituent order regularities inside the NP? (Section 4.6)

4.2 Case assignment

In Section 3.2.1.2, it was shown that the head in German and Spanish determines the form of its arguments. Concerning NPs, that means that the head noun *assigns* case to its arguments. Until now, this was formulated in AVMs as if the specific case information of the arguments were hard-wired in the head. Example (10) shows the relevant information of example (8) from Section 3.1.5. In (10), the head *Gewinn* 'win' licenses a complement NP which bears *genitive case*.

This is the view of case assignment proposed in Pollard and Sag (1994: 30). But such an account of case misses a very strong grammatical generalisation, namely

[12] There are more restrictions with respect to the pre-nominal genitives which will be accounted for in Section 4.6.

[13] There is in some varieties of Spanish a structure which allows a pre-nominal genitive. I will discuss this construction in Section 4.6.

(10) $$\begin{bmatrix} \text{PHON} & \langle \textit{Gewinn} \rangle \\ \text{SYNSEM}|\text{LOC}|\text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{CASE} & \textit{nom} \\ \text{INI} & + \\ \textit{noun} & \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{COMPS} & \langle \text{NP}[\textit{gen}] \rangle \end{bmatrix} \end{bmatrix} \\ \textit{word} & \end{bmatrix}$$

the distinction between *structural* and *inherent case* (sometimes also referred to as *lexical case*).[14]

Case is a grammatical category which some parts of speech (and phrasal types) bear. In some languages, for instance German as shown in Table 4.1, nouns and determiners are inflected for case, i.e. they are *morphologically* marked for case. The following examples in (11) illustrate the morphological variation in German nouns, determiners, and pronouns according to the case they bear.

(11) a. { *Er* / *Der* *Patient* } schläft.
he.NOM the.NOM patient.NOM sleeps
'The patient / He sleeps.'

b. Robert hat { *ihn* / *den* *Patienten* } angerufen.
Robert has him.ACC the.ACC patient.ACC called.
'Robert has called him / the patient.'

c. Rita hat { *ihm* / *dem* *Patienten* } geholfen.
Rita has him.DAT the.DAT patient.DAT helped
'Rita has helped him / the patient.'

d. Wir gedenken { *seiner* / *des* *Patienten* }.
we remember he.GEN the.GEN patient.GEN
'We remember him / the patient.'

In contrast to German, determiners and nouns in Spanish do not vary morphologically as shown in Table 4.2. But regarding the pronominal system in Spanish, the morphological variation becomes conspicuous. As already mentioned, Spanish has two classes of pronouns, clitic pronouns and free pronouns. The clitic pronouns can only be either accusative or dative, and they show the morphological variation

[14] For an overview of case distinctions, see Blake (2001) and Haspelmath (2009).

(cf. (12b) and (12c)).[15] The free pronouns, on the other hand, are marked *syntactically* for case with the dummy prepositions *a* 'to' in accusative[16] and dative, and with *de* 'of' in genitive,[17] while the nominative pronoun stays unmarked.

(12) a. { *El doctor* / *Él* } duerme.
the doctor he sleeps
'The doctor / He sleeps.'

b. Roberto *lo* ha llamado { *a él* / *a el doctor* }.
Roberto CL.ACC.SG.M has called to.ACC him to.ACC the doctor.
'Roberto has called him / the doctor.'

c. Rita *le* ha ayudado { *a él* / *a el doctor* }.
Rita CL.DAT.SG.M has helped to.DAT him to.DAT the doctor
'Rita has helped him / the doctor.'

d. la llamada { *de él* / *de-l doctor* }
the call of.GEN him of-the.GEN doctor
'his / the doctor's call'

Depending on the framework, this fact is modelled in different ways, and different theoretical assumptions are made. In MGG, a *universal* principle named *Case-Filter* is postulated by which every NP which is phonetically realised – in HPSG terminology: its PHON value is not empty – must bear case (cf. Chomsky, 1981: 49). This notion of case refers to the so-called *abstract case* (also named "Case" with capital "C" in GB). That is to say, (abstract) case is understood as an abstract syntactic feature which licenses the phonetic appearance of NPs in a phrase. This notion of "Case" in MGG (since GB) refers to the syntactic distribution of NPs in which Case is assigned, and not to the morphological form of the NPs (cf. Bobaljik and Wurmbrand, 2009: 44). The distributional notion of Case

[15] Free pronouns are normally used together with clitics. I will not go into the details of Spanish clitics, clitic left dislocation and clitic doubling, but for analyses of these phenomena, see Leonetti (2007) and Bildhauer (2007).

[16] In Spanish, the dummy preposition *a* 'to' in accusative only appears under specific semantic conditions. This phenomenon is known as *differential object marking* (cf. Bossong, 1982). See Machicao y Priemer (2014) for an analysis of the semantic factors.

[17] It is open to question whether Spanish marks nouns for genitive case. For the sake of the argument, I am assuming a genitive case marking here. See the arguments in Section 4.3.1 for the treatment of the preposition *de* 'of' as a marker of genitive case in Spanish.

distinguishes between two sorts of case: *structural* and *inherent case*. Structural case is assigned in a specific (surface-structural) configuration, while inherent case is associated with theta-roles (cf. Chomsky 1981: 170 and Chomsky 1995: 114). For instance, it is very common to consider nominative and accusative as structural cases. Example (13) shows the active-passive alternation by which the notion of structural case can be exemplified.[18]

(13) a. Ralf schreibt *einen Roman*.
Ralf.NOM writes a.ACC novel.ACC
'Ralf is writing a novel.'

b. *Ein Roman* wird geschrieben.
a.NOM novel.NOM is written
'A novel is being written.'

In MGG, it is assumed that the active sentence in (13a) and the passive sentence in (13b) share the same deep structure, only differing in their surface structures. The distinction between both is due to transformations from the deep to the surface structure. In this way, MGG approaches try to explain the relation between (13a) and (13b), that is, that *ein Roman* bears the same theta-role (theme) in both sentences, but since structural case is assigned on the surface structure, and both sentences have a different surface structure *ein Roman* bears accusative in (13a), and nominative in (13b). In contrast, dative is analysed as inherent case, since a parallel transformation from dative to nominative does not hold as example (14b) shows.[19]

(14) a. Ralf schreibt *seinem Vater* einen Roman.
Ralf.NOM writes his.DAT father.DAT a.ACC novel.ACC
'Ralf is writing a novel for is father.'

b. * *Sein Vater* wird einen Roman geschrieben.
his.NOM father.NOM is a.ACC novel.ACC written
'A novel is being written for his father.' [intended reading]

[18] For further examples of structural case variation, for instance raising and control, see Haider (1985: 71).

[19] Some phrases bearing dative can be assigned nominative by virtue of the so-called *Rezipientenpassiv* 'receiver-passive' (also called *dative-passive*) in German. See for instance Haider (1986: 19–24); and Müller (2016b) for an HPSG analysis of this phenomenon. To which extent dative is (not) considered a structural case is a matter of discussion (cf. Haider, 1985: 65–67).

c. Ein Roman wird *seinem Vater* geschrieben.
a.NOM novel.NOM is his.DAT father.DAT written
'A novel is being written for his father.'

As mentioned above, the notion of case in HPSG in Pollard and Sag (1994: 30) assumes that for each argument of a head a *specific* case was hard-wired in the SUBCAT constraints of the head. In order to account for the distinction between structural and inherent/lexical[20] case, a special case theory in HPSG emerged (cf. for instance Heinz and Matiasek 1994; Pollard 1994; Meurers 1999; Przepiórkowski 1999). Although both, the Case-Theory in MGG and in HPSG, are similar in that they assume a difference between structural and lexical case, they differ in one crucial point, namely what does it mean to be "structural"? For MGG, the question about structure, is a question which has to be answered in terms of competence leading to an approach aiming universality. On the other hand, HPSG does not try to give a universal answer, but one which aims at being descriptively adequate. For (some) HPSG approaches, universality[21] is something that *could* be achieved, but it is not the primary goal. Therefore, a case principle in MGG and HPSG does not (*need to*) have the same coverage; for HPSG at least not a priori, but it can be a welcome result a posteriori.

Now, since HPSG is a lexicalist theory, structural as well as lexical case, are assigned "lexically", and not in a specific position in a tree configuration (cf. Richter, 2000: 325–326). Nevertheless, which specific *structural case* is assigned, depends on the structural context in which the NP appears, as was shown by the examples in (13). *Lexical case*, however, is assigned idiosyncratically, i.e. the case-assigning head constraints the specific CASE value its argument must bear in order to license

[20]Instead of the term *inherent case*, sometimes the term *lexical case* is preferred, since it is assumed that this kind of case marking is determined by the lexical head, while *structural case* marking is a matter of the structural context in which the NP appears (cf. Haider, 1985: 70–71). Other terms also used for inherent/lexical case are *idiosyncratic case* (cf. Richter, 2000: 326) and *invariable case* (cf. Haider, 1986: 9).

[21]The question of language universals is a very sensitive issue in linguistics which seems to have become a question of faith more than of science, with respect to *both* positions. I do not *know* if there are any language universals, but I will neither preclude their existence nor assume them. I *think* that it is important to have frameworks working on it, as well as others which do not assume them at all in order to be able to find them – if there are any. For some discussions on this topic see e.g. Evans and Levinson (2009) and the responses to their target article therein; Sternefeld and Richter (2012); Müller (2016a: 431–487); a.o.

a grammatical structure, as was shown in example (14). It is worth mentioning that it is not possible to divide the set of cases into two non-intersecting subsets of “structural” vs. “lexical cases”, neither language specifically and much less universally. This would yield misleading interpretations of the notion of case and of case assignment in the literature, for instance in Chomsky (1981: 170) genitive is seen as structural, but in Chomsky (1995: 114) it is analysed as inherent. It is of great importance to distinguish case assignment between languages and also between phrasal types. Haider (1985: 80–81) considers, for instance, genitive *in German* as an instance of structural case *for NPs*, but *for VPs* (cf. example (15c)) as inherent – ‘invariant’ in his terminology (cf. Haider, 1986: 9). Furthermore, inside of German VPs (or of sentences) nominative and accusative are not *always* structural. To illustrate that, the examples in (15) show (cf. the NPs in italics): an NP in lexical nominative (cf. (15a)), and an NP in lexical accusative (cf. (15b)).[22]

(15) a. Sein Sohn wird *ein großartiger Frisör*.
his.NOM son.NOM will an.NOM excellent.NOM hairdresser.NOM
‘His son will become an excellent hairdresser.’

b. Ralf hat *den ganzen Tag* einen Roman gelesen.
Ralf.NOM has the.ACC whole.ACC day.ACC a.ACC novel.ACC read
‘Ralf has being reading a novel all day long.’

c. Wir gedenken *der Opfer*.
we.NOM commemorate the.GEN victims.GEN
‘We commemorate the victims.’

In order to account for these facts, the first tool in HPSG to distinguish between case forms is a type hierarchy of case as the one given in Figure 4.1 in which nominative, accusative, dative, and genitive are represented as lexical cases, and nominative, accusative, and genitive also as structural cases (cf. additionally Heinz and Matiasek 1994: 207 and Müller 2013a: 230).

The type hierarchy for case has *case* as the supertype which is divided into the single cases *nom*, *acc*, *dat*, and *gen*, and a further value *structural-case* (*str*), which is the supertype for structural cases. Every single case has a maximal subtype for

[22] As a marginal note: While in (15a) and (15c) nominative and genitive, respectively, can be considered as *lexical* cases strictly speaking, because the head must lexically determine which case these arguments bear, the term *lexical case* seems to be a misnomer for (15b) since it is not a property of the *lexical* element *lesen* ‘to read’ to assign this accusative, but rather of the temporal “construction” *den ganzen Tag* ‘all day long’.

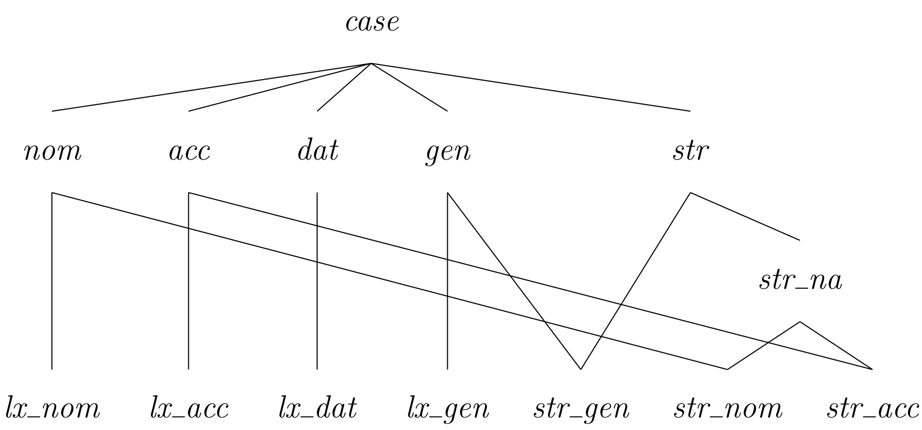

Figure 4.1: Type hierarchy for case

its corresponding lexical form (*lx_nom*, *lx_acc*, *lx_dat*, and *lx_gen*), since all cases can be used as lexical cases as well. Since nominative, accusative, and genitive can be assigned in structural contexts too – at least for German and Spanish – they have also structural subtypes, i.e. subtypes of *str*. Since for VPs, *str_nom* and *str_acc* are used as structural cases, they both have a supertype *str_na*. For NPs, the only structural case needed in Spanish and German is *str_gen*.

A further instrument to capture the generalisation of case assignment is the so-called *Case Principle* (CaseP) which interacts with the type hierarchy for case given in Figure 4.1. The idea of the CaseP is that through this constraint it can be licensed which case the arguments must bear in cases of structural case. This principle, for instance, accounts for the case alternation in active and passive shown in example (13), and as we will see later, also for the genitive assignment for arguments in NPs. In order to account for a device which assigns case according to specific structural contexts, some modifications in the feature geometry have been made.

Firstly, a new *list* valued ARGUMENT-STRUCTURE (ARG-ST) attribute has been brought up in the CAT feature.[23] A similar idea was brought by Pollard and Sag (1994: 376) with respect to the treatment of SUBCAT after introducing the VAL features. Thus, ARG-ST is to some extent parallel to the earlier SUBCAT attribute, that is, it represents a list of all arguments of the head (cf. Sag and Godard 1994: 524; Manning and Sag 1998: 107; Koenig 1999: 29; and Przepiórkowski 1999: 24–27).

[23]I am following Koenig (1999: 29) and considering ARG-ST as an attribute of CAT and not of HEAD as in Przepiórkowski (1999).

The elements of the ARG-ST list are *normally* the concatenation of the elements in the VAL attributes: SUBJ, SPR, and COMPS, but there is not an obligatory one-to-one representation between ARG-ST and VAL (cf. Bouma et al., 2001: 7). For instance, a difference between ARG-ST and VAL can be found in so-called *pro*-drop languages like Spanish in which the subject argument is not necessarily realised. In such cases, the *pro* element representing the subject is not included in the SUBJ list, since this list is used for syntactic complementation as defined at the beginning of Section 4, but it is nevertheless included in the ARG-ST list, since this argument is necessary for binding (cf. Manning and Sag 1998; Przepiórkowski 1999: 24–27; and Bouma et al. 2001: 9–10).

As it is shown in example (16) for the German verb stem *behandel-* 'treat', the single elements of the VAL lists are structure-shared with the elements in the ARG-ST list.[24]

(16)
$$\begin{bmatrix} \text{PHON} & \left\langle \textit{behandel-} \right\rangle \\ \text{SYNSEM}|\text{LOC}|\text{CAT} & \begin{bmatrix} \text{HEAD} & \left[\textit{verb}\right] \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \boxed{1} \left\langle \text{NP}[\textit{nom}] \right\rangle \\ \text{COMPS} & \boxed{2} \left\langle \text{NP}[\textit{acc}] \right\rangle \end{bmatrix} \\ \text{ARG-ST} & \boxed{1} \oplus \boxed{2} \end{bmatrix} \\ \textit{word} & \end{bmatrix}$$

The elements of the ARG-ST list are normally ordered according to the *Accessibility Hierarchy* (cf. (17), sometimes called *Obliqueness Hierarchy*) proposed in Keenan and Comrie (1977) which has been proved to be very useful for independent linguistic phenomena such as passive, relative clauses, binding, extraction, etc.[25]

[24]Structure sharing between the elements of the VAL attributes and of the ARG-ST can be achieved either by a general principle called *Argument Realisation Principle* (cf. Bildhauer, 2007: 14–15) which maps the elements in the VAL lists to the elements in the ARG-ST in a specific order, or it can be solved by constraints on types of lexical classes, since, for instance, direct and indirect objects of verbs can show distinct degrees of obliqueness, see for instance Footnote 25. See Section 4.3.1.2 for more details on the mapping between ARG-ST and VAL.

[25]With respect to the ordering of direct and indirect object, other proposals have been made, for instance the ordering Indirect Object > Direct Object for specific verb classes. See the discussion in Müller (2013a: 45–46). It is noteworthy that this ordering does *not* (need to)

(17) Accessibility Hierarchy (Keenan and Comrie, 1977: 66)
Subject > Direct Object > Indirect Object > Oblique Object > Genitive > Object of Comparison

A second modification in the feature geometry concerns the type of the single elements in the SUBJ, SPR, COMPS, and ARG-ST lists. Until now, they were treated as objects of type *synsem*. Since raising is one of the decisive contexts for structural case assignment (cf. example (18)),[26] it is necessary to mark these objects as raised or not raised. Example (18a) shows the subject of the verb *schlafen* 'sleep' in nominative, but in example (18b) the same subject has been raised to the superordinate VP and gets its case from the superordinate verb *sehen* 'see' which embeds *schlafen*. Since the subject is marked as bearing structural case, it can get nominative in (18a), but only accusative in (18b).

(18) a. *Er* schläft.
he.NOM sleeps
'He is sleeping.'

b. Ich sehe *ihn* schlafen.
I.NOM see him.ACC sleep
'I see him sleeping.'

In the new feature geometry (cf. AVM (19)), the elements of the VAL lists are of type *argument* (*arg*) which are defined as having two attributes ARGUMENT (ARG) and RAISED (RSD); ARG is of type *synsem* and RSD of type *bool*. That is to say, arguments which are realised locally – e.g. the subject of *schlafen* in (18a) – are marked as "RSD −", and if they are not realised locally – e.g. the subject of *schlafen* in (18b) – then they are marked as "RSD +" (cf. Przepiórkowski 1999: 93 and Richter 2000: 329–330).[27] As mentioned above, the elements of the VAL lists are structure-shared with the elements of the ARG-ST list, therefore, they must be elements of the same type.

reflect the linear constituent order. See also Fries (1997: 51–59) for a discussion about the hierarchical ordering of cases in German.

[26] For instance in AcI constructions, see Reis (1976); Haider (1985); Meurers (1999: 179–181); Przepiórkowski (1999); a.o.

[27] Przepiórkowski (1999: 78) first proposed an attribute REALIZED. Here, I am assuming his later proposal of the attribute RAISED instead. See Przepiórkowski (1999: 93) and Meurers (1999: 199–200) for further discussion on both attributes.

(19)
$$
\left[\begin{array}{ll}
\textsc{synsem}|\textsc{loc}|\textsc{cat} & \left[\begin{array}{ll}
\textsc{val} & \left[\begin{array}{ll}
\textsc{subj} & \left\langle \boxed{1}\left[\begin{array}{ll}\textsc{arg} & \textit{synsem}\\ \textsc{rsd} & \textit{bool}\\ \multicolumn{2}{l}{\textit{arg}}\end{array}\right]\right\rangle\\
\textsc{comps} & \left\langle \boxed{2}\left[\begin{array}{ll}\textsc{arg} & \textit{synsem}\\ \textsc{rsd} & \textit{bool}\\ \multicolumn{2}{l}{\textit{arg}}\end{array}\right], \boxed{3}\left[\begin{array}{ll}\textsc{arg} & \textit{synsem}\\ \textsc{rsd} & \textit{bool}\\ \multicolumn{2}{l}{\textit{arg}}\end{array}\right]\right\rangle
\end{array}\right]\\
\textsc{arg-st} & \left\langle \boxed{1}, \boxed{2}, \boxed{3}\right\rangle
\end{array}\right]\\
\multicolumn{2}{l}{\textit{word}}
\end{array}\right]
$$

Now with the type hierarchy for case in Figure 4.1, and the new feature geometry in AVM (19), it is possible to capture the generalisation with respect to structural case assignment, as postulated in the CaseP.[28]

(20) Case Principle (CaseP)

a. In an ARG-ST list of a *verbal head*,

i. the first not-raised element of the list with structural case receives *nominative* (*str_nom*),

ii. and all further not-raised elements of the list with structural case receive *accusative* (*str_acc*).

b. In an ARG-ST list of a *nominal head*,

i. all not-raised elements of the list with structural case receive *genitive* (*str_gen*).

Thus, the CaseP is divided into a clause for verbal heads (cf. (20a)), and a clause for nominal heads (cf. (20b)), since – as mentioned above – structural cases for VPs are nominative and accusative, and genitive for NPs – at least for German and Spanish. Moreover, the CaseP is formulated in such a way that case is assigned with respect to the elements in the ARG-ST list and not to the elements in the VAL lists. Case assignment as well as other phenomena (e.g. active-passive alternation, binding phenomena, etc.) are not related to the elements in the VAL attributes, but to the elements in the ARG-ST list (cf. Meurers, 1999: 203).[29] Furthermore,

[28] For different formulations of the CaseP, see Heinz and Matiasek (1994: 208–211); Meurers (1999: 204); Müller (1999: 278); Przepiórkowski (1999: 93–94); Müller (2016a: 278); a.o.

[29] Furthermore, so-called *pro*-drop languages like Spanish do not necessarily realise their subject argument. Thus, the *pro* element representing the subject is not included in the SUBJ list, but

the single constraints (cf. (20a-i), (20a-ii), and (20b-i)) refer to *not-raised* elements (cf. Przepiórkowski, 1999: 77), since raised elements get their case assignment from their new host (cf. example (18)). Thus, the CaseP assigns nominative to the first not-raised element in the ARG-ST list of a verb, and accusative for the following ones; but genitive to all elements of the ARG-ST list of a noun.

The formalisation of the CaseP as an implicational constraint can be seen in (21). It is based on the CaseP given in Przepiórkowski (1999: 93–94) and expanded for NPs. The CaseP is divided into an implicational constraint for each clause of the principle given in (20): the first one assigning nominative (cf. (20a-i)), the second one accusative (cf. (20a-ii)), and the third one genitive (cf. (20b-i)).

(21) Case Principle (CaseP)

$$\begin{bmatrix} \textsc{head} & \textit{verb} \\ \textsc{arg-st} & \left\langle \begin{bmatrix} \textsc{arg} & \text{NP}[\textit{str}] \\ \textsc{rsd} & - \end{bmatrix} \right\rangle \oplus \boxed{1} \end{bmatrix} \rightarrow \begin{bmatrix} \textsc{arg-st} & \left\langle \begin{bmatrix} \textsc{arg} & \text{NP}[\textit{str\_nom}] \end{bmatrix} \right\rangle \oplus \boxed{1} \end{bmatrix}$$

$$\begin{bmatrix} \textsc{head} & \textit{verb} \\ \textsc{arg-st} & \boxed{1}\ \textit{nelist} \oplus \left\langle \begin{bmatrix} \textsc{arg} & \text{NP}[\textit{str}] \\ \textsc{rsd} & - \end{bmatrix} \right\rangle \oplus \boxed{2} \end{bmatrix} \rightarrow \begin{bmatrix} \textsc{arg-st} & \boxed{1} \oplus \left\langle \begin{bmatrix} \textsc{arg} & \text{NP}[\textit{str\_acc}] \end{bmatrix} \right\rangle \oplus \boxed{2} \end{bmatrix}$$

$$\begin{bmatrix} \textsc{head} & \textit{noun} \\ \textsc{arg-st} & \boxed{1}\ \textit{list} \oplus \left\langle \begin{bmatrix} \textsc{arg} & \text{NP}[\textit{str}] \\ \textsc{rsd} & - \end{bmatrix} \right\rangle \oplus \boxed{2}\ \textit{list} \end{bmatrix} \rightarrow \begin{bmatrix} \textsc{arg-st} & \boxed{1} \oplus \left\langle \begin{bmatrix} \textsc{arg} & \text{NP}[\textit{str\_gen}] \end{bmatrix} \right\rangle \oplus \boxed{2} \end{bmatrix}$$

For the formalisation, the ARG-ST list is divided into smaller lists in order to get access to the arguments. For the second and the third clause, the types *non-empty-list* (*nelist*) and *list* are used for this division.[30] The second clause states that there

it is nevertheless included in the ARG-ST list, since it is necessary for example for binding (cf. Przepiórkowski, 1999: 24–27).

[30] The supertype *list* has two subtypes *empty-list* (*elist*), i.e. a list without elements, and *non-*

must be a list with at least one element (cf. *nelist*) before the argument which gets accusative. The third clause states that there *can* be one or more elements (cf. *list*) before and one or more elements after the argument which gets genitive, since *list* can be either the empty list or the non-empty list.

In order to exemplify how the CaseP works, I am using the example (16), repeated here as (22), expanded with the semantic information and with the new case information. Furthermore, in (24) the passive participle form of (22) is given. I am not going into the details of how passive works, since this is not the topic of this work, but passivisation is one of the most perspicuous phenomena with respect to structural case (cf. the literature given in Footnote 28).

(22)
$$\begin{bmatrix} \text{PHON} & \langle \textit{behandel-} \rangle \\ \text{SYNSEM|LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & [\textit{verb}] \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \langle \boxed{1}\ \text{NP}[\textit{str}]_{\boxed{4}} \rangle \\ \text{COMPS} & \langle \boxed{2}\ \text{NP}[\textit{str}]_{\boxed{5}} \rangle \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{1}\ ,\ \boxed{2} \rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{3}\ \textit{event} \\ \text{RELS} & \left\langle \begin{bmatrix} \text{EVENT} & \boxed{3} \\ \text{AG} & \boxed{4} \\ \text{TH} & \boxed{5} \\ \textit{treat} & \end{bmatrix} \right\rangle \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\ \textit{stem} & \end{bmatrix}$$

The verb stem *behandel-* ‘treat’ in (22) has a subject and a complement in its valence which get both structural case. Both are structure-shared with the ARG-ST list in order to get their case specified according to the CaseP. Additionally, the indices of the arguments are structure-shared with the specific theta-roles in the RELS attribute. This lexical entry can be used to license the sentence in (23a), in which the subject gets nominative and is interpreted as the agent of the event

empty-list (*nelist*), i.e. a list which must contain at least one element. The supertype *list* is underspecified with respect to its emptyness.

represented by the verb and the complement gets accusative and is interpreted as the theme of the event represented by the verb.

(23) a.

Der	Arzt	behandelt	*den*	*Patienten.*
the.NOM	doctor.NOM	treats	the.ACC	patient.ACC

‘The doctor is treating the patient.’

b.

Der	*Patient*	wird	(von	dem	Arzt)	behandelt.
the.NOM	patient.NOM	is	by	the.DAT	doctor.DAT	treated

‘The patient is being treated (by the doctor).’

By means of a lexical rule,[31] the stem in (22) can be related to an object of type *word* like (24) which has the VFORM value *participle-perfect-passive* (*ppp*).

(24)
$$\begin{bmatrix} \text{PHON} & \langle \textit{behandelt} \rangle \\ \text{SYNSEM|LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{ppp} \\ \textit{verb} & \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \langle \boxed{2}\ \text{NP}[\textit{str}]_{\boxed{5}} \rangle \\ \text{COMPS} & \langle (\boxed{1}\ \text{PP}[\textit{von/durch}]_{\boxed{4}}) \rangle \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{1}\ ,\ \boxed{2} \rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{3}\ \textit{event} \\ \text{RELS} & \left\langle \begin{bmatrix} \text{EVENT} & \boxed{3} \\ \text{AG} & \boxed{4} \\ \text{TH} & \boxed{5} \\ \textit{treat} & \end{bmatrix} \right\rangle \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\ \textit{word} & \end{bmatrix}$$

That is to say, the stem that could be used for the active sentence in (23a), can now be used for the passive sentence in (23b). In a passive sentence, the element which was the subject in the active form (cf. $\boxed{1}$ in (22)) is suppressed or expressed as a PP (cf. $\boxed{1}$ in (24)),[32] and the element which served as object in the active

[31] Here, I am skipping many details about passivisation, see Pollard (1994), Müller (2013a: 287–343), and the literature given in Footnote 28 for passive accounts in HPSG.

[32] The preposition of the agent could be considered as a dummy preposition. In Section 4.3.4.1,

form (cf. $\boxed{2}$ in (22)) is represented as the new subject (cf. $\boxed{2}$ in (24)). Further, the theta-role assignment does not change (cf. linking of AG and TH in (22) and (24)). Thus, *der Patient* 'the patient' bears a different case in example (23b) than in (23a), since according to the CaseP, it is the *first* element with structural case in (24), while in (22), it is the second element with structural case. The theta-role in both cases does not vary.

4.3 Case assignment in NPs

Now that the generalisation for case assignment, viz. CaseP, has been clarified, it will be shown how this principle applies to NPs in German and Spanish.[33] The third clause of the CaseP presented in (20b) postulates that genitive is assigned to all arguments of a nominal head which bear structural case. This clause can be applied to German as well as to Spanish NPs, despite the fact that German case is marked morphologically, while Spanish case is marked syntactically (by means of a "preposition").

In order to show how the CaseP applies to NPs, it is necessary to clarify the relevant information in the head. In other words,

1. What is the head subcategorised for?

2. How many complements of the head can be realised? and

3. Which information must the complements bear?

To answer these questions, I will use event nominalisations, since the existence and cardinality of arguments is less controversial in event nominalisations than it is in other kinds of relational nouns. For instance, in Valence Theory, Ágel

I will show the characteristics of dummy prepositions with respect to case marking in Spanish. Furthermore, the agent PP is optional, and often it is considered as an adjunct. In Section 4.4, I am going to show how optional objects can be accounted for in HPSG.

[33]For other languages extensions of this principle are necessary. For instance, as can be seen in Comrie (1976: 194–196), Classical Arabic deverbal nouns can assign genitive to one phrase, a further phrase though must appear in nominative or accusative, according to its case assignment by the verbal base. Also, both arguments can appear with their verbal cases: nominative and accusative, with no argument in genitive. The combination of head noun and genitive NP in Classical Arabic is called the "construct" and shows further properties that are not of immediate interest here, but the interested reader is referred to Comrie (1976).

(2000: 59–64) proposes that the relational noun *Schwester* 'sister' is not able to structure its NP, i.e. it has no (syntactic) valence, and thus no arguments despite its relational nature.[34] For the nominalised verb *Hoffnung* 'hope' though, he discusses the possibility of a "kind of valence", which he calls 'formal specificity' (cf. see also Jacobs 1994b: 22), since *Hoffnung* can select an NP in accusative marked with the preposition *auf* 'for'.

Therefore, in order to avoid this controversy,[35] I am working here with event nominalisations which inherit the argument structure of their root verbs. Firstly, I will provide a lexical rule to account for event nominalisations. This lexical rule (cf. Section 4.3.1.1) interacting with further constraints on nominal stems (cf. Section 4.3.1.2) will give answers to the questions in 1 and 2. And finally, the question in 3 will be answered in Sections 4.3.2–4.3.4, in which the differences in case marking between German and Spanish will be discussed, yielding the constraints which license the complement NPs.

4.3.1 Event Nominalisation

First of all, the CaseP only applies if there is a lexical entry with structural case information in the elements of its ARG-ST list. Therefore, the first thing we need is the lexical entry of the noun. In examples (1)–(2) in Section 4.1, repeated here as (25)–(26), it is shown that some kinds of nominalisations keep the argument structure of their verbal root. This is the case for the so-called event nominalisation through the affixes *-ung* in German and *-miento* in Spanish (similar to *-ment* in English). Nominalisations with *-ung* and *-miento* can be interpreted as different kinds of nominalised *eventualities*,[36] for instance as processes, states, or result

[34] Ágel (2000: 64) ascribe relational nouns such as *Schwester* 'sister' in *die Schwester des Kindes* 'the sister of the child' the possibility to open a *semantic* relation between the head noun and the adjacent constituent marked with genitive *des Kindes*. This relation is – according to him – not a syntactic one, but only semantic in nature. In Section 4.5, I will discuss the differences between sortal nouns and relational nouns also with respect to their syntactic arguments and semantic arguments.

[35] See Bücking (2012), and Section 4.5 for a discussion about genitive phrases in NPs and their analysis as modifiers vs. arguments.

[36] Remember that the term *eventuality* is the general concept and the term *event* only a sub-kind of eventuality. I am using here, as is customary, the term *event* instead of *eventuality* and only disambiguating both if necessary. See Bach (1986) and Maienborn (2011) for further details.

objects, or as events (as a proper sub-kind of eventuality),[37] see Ehrich and Rapp (2000) and Dölling (2015) for a semantic analysis of the German affix; and RAE, 2010a: 359–366 for a description and Fábregas (2010) for an analysis of the Spanish counterpart.

(25) a. Der Arzt behandelt den Patienten.
the.NOM doctor.NOM treats the.ACC patient.ACC
'The doctor treats the patient.'

b. die Behandlung des Arztes
the treatment the.GEN doctor.GEN
'the treatment of the doctor'

c. die Behandlung des Patienten
the treatment the.GEN patient.GEN
'the treatment of the patient'

(26) a. El doctor trata a-l paciente.
the.NOM doctor.NOM treats to-the.ACC patient.ACC
'The doctor treats the patient.'

b. el tratamiento de-l doctor
the treatment of-the.GEN doctor
'the treatment of the doctor'

c. el tratamiento de-l paciente
the treatment of-the.GEN patient
'the treatment of the patient'

As was pointed out in Section 4.1, only one of the arguments with structural case can be realised in post-nominal position (cf. (25b), (25c), (26b), and (26c)), but not both at the same time (cf. (27a) and (27b)).

(27) a. * die Behandlung [des Arztes] [des Patienten]
the treatment the.GEN doctor.GEN the.GEN patient.GEN
'the treatment of the patient by the doctor' [intended reading]

b. * el tratamiento [de-l doctor] [de-l paciente]
the treatment of-the.GEN doctor of-the.GEN patient
'the treatment of the patient by the doctor' [intended reading]

[37] According to Grimshaw (1992: 49–54), it depends on the specific sub-kind of nominalised eventuality whether the argument structure is maintained or not. Since this fact does not interfere with the assumptions made here, I am not going into further details. I will discuss Grimshaw's approach in more detail in Section 4.5.

Thus, the event nominalisation has some similarities with the passivisation of verbs since both demote one of the arguments of the head.[38] While passivisation demotes the first element in the ARG-ST list which has structural case of the active counterpart, i.e. the argument in nominative, the event nominalisation does not select a *particular* argument. Moreover, both arguments with structural case – the "subject" as well as the "object" argument – can be realised, though not both at the same time. What is more, this demotion affects neither the arguments with lexical case nor the prepositional objects. Arguments with lexical case or prepositional objects can co-occur with the arguments bearing structural case.[39] That is to say, the post-nominal position is not constraint to have at most one argument, but *at most one argument with structural case*, as the following examples in (28) show.

(28) a. [Der Arzt] befragt [den Patienten] [nach seinem Zustand].
the.NOM doctor.NOM asks the.ACC patient.ACC about his condition
'The doctor interviews the patient about his condition.'

b. die Befragung [des Arztes] [nach meinem Zustand]
the questioning the.GEN doctor.GEN about my condition
'the interview of the doctor about my condition'

c. die Befragung [des Patienten] [nach seinem Zustand]
the questioning the.GEN patient.GEN about his condition
'the interview of the patient about his condition'

d. * die Befragung [des Arztes] [des Patienten]
the questioning the.GEN doctor.GEN the.GEN patient.GEN
'the interview of the patient by the doctor' [intended reading]

[38] See also Bierwisch (1989: 60), who also shows the parallels between passives and event nominalisations, but from a semantic perspective.

[39] As Bücking (2012: 35) points out – referring back to Reis (1988) – that elements with lexical case cannot appear neither with genitive, nor with their original cases, as his examples (i) and (ii) show. Arguments with lexical case can appear at most as PPs in the NP.

(i) Die Köchin vertraut ihrem Lehrling.
the cook trusts her.DAT apprentice
'The cook has confidence in her apprentice.'

(ii) ihr Vertrauen { * ihres / * ihrem / *in* ihren } Lehrling
her confidence her.GEN her.DAT in her apprentice
'her confidence in her apprentice'

e. * die Befragung [des Arztes] [des Patienten] [nach seinem Zustand]
the questioning the.GEN doctor.GEN the.GEN patient.GEN about his condition
'the interview of the patient by the doctor about his condition' [intended reading]

The German verb *befragen* '(to) question' has three arguments, two with structural case, the "subject" and the "object", and one prepositional argument with *nach* 'about' (cf. (28a)). The nominalisation *Befragung* 'questioning' allows the "subject" and the "object" to combine with the PP argument (cf. (28b) and (28c), respectively), but it does not allow neither the combination of both arguments with structural case (cf. (28d)), nor of both arguments with structural case and PP argument (cf. (28e)). The same holds for Spanish.[40] But since Spanish structural genitive is realised by the preposition *de* 'of' (cf. (26)), this is strong evidence for two assumptions made above. Firstly, there *is* structural genitive in Spanish, since these phrases behave differently from *real* prepositional phrases. Secondly, the preposition *de* 'of' marking structural genitive is *not* a real but only a *dummy* preposition.

Now, in order to account for these facts, one of the possibilities would be to postulate a lexical rule in order to produce a lexical item for each possible combination of arguments. For the noun *Behandlung* 'treatment', we would have to assume at least three lexical items: one for a noun combined with the subject argument (cf. (25b)), one for a noun combined with the object argument (cf. (25c)), and one for a noun without arguments (cf. (3a)). The noun *Befragung* 'questioning' would even require six lexical items. That is, assuming a lexical item for every possible combination of the noun with its arguments would lead to the unsatisfactory result of a very big lexicon missing the interesting generalisation of the demotion of one argument with structural case, that is the similarity to passive (cf. Grimshaw 1992: 108–112 for a similar view, but a different conclusion). Furthermore, the fact that the existence of the non-realised argument is though semantically implied (cf. Section 3.2.1.1) is not covered by different lexical items which just delete the non-realised arguments. Therefore, the account I am proposing here makes use of:

[40] Due to space reasons, I am not giving the Spanish examples here. The analysis of the dummy prepositions will be seen in Section 4.3.4.

- firstly, a lexical rule which maps a verbal stem like (29)[41] to a noun stem like (30), changing the value of its ARG-ST, its part of speech, and its semantics;[42]
- secondly, a constraint on mapping the elements of the ARG-ST list to the elements of the VAL list; and
- thirdly, the CaseP as already presented.

(29)
$$\begin{bmatrix} \textsc{phon} & \left\langle \textit{behandel-} \right\rangle \\ \textsc{synsem}|\textsc{loc} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textit{verb} \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{subj} & \left\langle \boxed{1} \right\rangle \\ \textsc{comps} & \left\langle \boxed{2} \right\rangle \end{bmatrix} \\ \textsc{arg-st} & \left\langle \boxed{1}\ \mathrm{NP}[\textit{str}]_{\boxed{4}}\ ,\ \boxed{2}\ \mathrm{NP}[\textit{str}]_{\boxed{5}} \right\rangle \end{bmatrix} \\ \textsc{cont} & \begin{bmatrix} \textsc{ind} & \boxed{3}\ \textit{event} \\ \textsc{rels} & \left\langle \begin{bmatrix} \textsc{event} & \boxed{3} \\ \textsc{ag} & \boxed{4} \\ \textsc{th} & \boxed{5} \\ \textit{treat} & \end{bmatrix} \right\rangle \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\ \textit{stem} & \end{bmatrix}$$

4.3.1.1 Lexical Rule: Event Nominalisation

The lexical rule of type *ung-noun-derivation-lexical-rule* (*ung-noun-drvtn-lr*) given in (31) must take a verbal stem, that is a verb without inflection as input (the *-ung* affix is provided by the lexical rule), delivering a noun stem as output which can be inflected. The constraints on the LEX-DTR state that its value must be a verbal stem, i.e. an object of type *stem* with the HEAD value *verb*. Furthermore

[41] Since according to the CaseP given in (21), case is assigned to the elements in the ARG-ST list, the abbreviations of the NPs are given in the ARG-ST list. Since structure sharing represents token identity the AVMs in (22) and (29) are completely equivalent.

[42] Take into account that the index value has changed from type *event* to *index*.

(30)

$$
\begin{bmatrix}
\text{PHON} & \langle \textit{Behandlung} \rangle \\
\text{SYNSEM}|\text{LOC} & \begin{bmatrix}
\text{CAT} & \begin{bmatrix}
\text{HEAD} & \begin{bmatrix} \text{CASE} & \textit{case} \\ \text{INI} & + \\ \textit{noun} & \end{bmatrix} \\
\text{VAL} & \begin{bmatrix} \text{SPR} & \langle \boxed{7}\ \text{DP} \rangle \\ \text{SUBJ} & \langle\ \rangle \\ \text{COMPS} & \langle \Box \rangle \end{bmatrix} \\
\text{ARG-ST} & \langle \boxed{7}\ ,\ \boxed{1}\ \text{NP}[\textit{str}]_{\boxed{4}}\ ,\ \boxed{2}\ \text{NP}[\textit{str}]_{\boxed{5}} \rangle
\end{bmatrix} \\
\text{CONT} & \begin{bmatrix}
\text{IND} & \boxed{6}\ \textit{index} \\
\text{RELS} & \left\langle \begin{bmatrix} \text{INST} & \boxed{6} \\ \text{PROC} & \boxed{3} \\ \textit{ung-noun} & \end{bmatrix} , \begin{bmatrix} \text{EVENT} & \boxed{3} \\ \text{AG} & \boxed{4} \\ \text{TH} & \boxed{5} \\ \textit{treat} & \end{bmatrix} \right\rangle \\
\textit{mrs} &
\end{bmatrix}
\end{bmatrix} \\
\textit{stem} &
\end{bmatrix}
$$

it states that the PHON, ARG-ST, IND, and RELS values are structure-shared in the derivation. The derivational suffix *-ung*, more precisely the lexical rule, is constrained as an element with INDEX value of type *index* specified for 3rd person feminine. The RELS value of the lexical rule denotes an object of type *index* (cf. $\boxed{5}$) which is the nominalisation of the process of an event (cf. $\boxed{6}$). $\boxed{6}$ is structure-shared with the IND value of the LEX-DTR, and both must be of the same type *event*. As it was mentioned above, nominalisations with the affixes *-ung* or *-miento* can denote not only processes but also other sub-kinds of events (viz. eventualities). Therefore, the distinction between the different sub-kinds of *ung*-nouns can be modelled by means of different types of relations provided by distinct lexical rules, e.g. *ung-proc-noun* for processes.

The *ung*-noun thus takes the IND value of the affix. Its RELS value is the concatenation of the RELS values of the affix and the verbal stem. In the HEAD attribute, it is specified as a noun, but it is not further specified for case since it is a noun *stem*, i.e. it is not inflected yet. The lexical rule adds further two constraints into the VAL lists. Firstly, it adds the subcategorisation for a specifier, which was not constrained in the verbal stem. Secondly, it constraints the SUBJ list to be empty. Moreover, the ARG-ST of the noun is the result of the concatenation of the value of the SPR and the value of the ARG-ST list of the verbal stem. As it can be seen in (31), the lexical rule says nothing about the COMPS list. That is, which elements are in the COMPS list is regulated through a constraint mapping elements of ARG-ST and VAL, as shown in the following section.

4.3.1.2 Mapping between ARG-ST and VAL

The major challenge we had with respect to complementation had to do with the VAL lists. As shown in the examples (25)–(28), it is possible to overtly realise several arguments of the noun, but only one of them can be an argument with structural case. The lexical rule presented in (31) did not reveal much about how this problem can be solved, since the COMPS list of the noun was left unconstrained. The reorganisation of the VAL list from verb to noun must consider the following aspects:

1. The SUBJ list in the noun must be empty, since there is no necessity to use a *head-subject-structure* to combine elements.[43]

[43]This holds for non-predicative NPs. Predicative NPs like *professor* in *Manfred is a professor.*

(31) Lexical Rule: *-ung*-Nominalisation

$$\left[\begin{array}{ll}
\text{PHON} & f(\boxed{1}\,,\left\langle \textit{-ung}\right\rangle) \\
\text{SYNSEM}|\text{LOC} & \left[\begin{array}{ll}
\text{CAT} & \left[\begin{array}{ll}
\text{HEAD} & \left[\textit{noun}\right] \\
\text{VAL} & \left[\begin{array}{ll} \text{SPR} & \boxed{3}\left\langle \text{DP} \right\rangle \\ \text{SUBJ} & \left\langle\, \right\rangle \end{array}\right] \\
\text{ARG-STR} & \boxed{3} \oplus \boxed{4}
\end{array}\right] \\
\text{CONT} & \left[\begin{array}{ll}
\text{IND} & \boxed{5}\left[\begin{array}{ll} \text{PER} & \textit{3} \\ \text{GEND} & \textit{fem} \\ \multicolumn{2}{l}{\textit{index}} \end{array}\right] \\
\text{RELS} & \left\langle \left[\begin{array}{l} \text{INST } \boxed{5} \\ \text{PROC } \boxed{6}\ \textit{event} \\ \textit{ung-proc-noun} \end{array}\right] \right\rangle \oplus \boxed{2} \\
\multicolumn{2}{l}{\textit{mrs}}
\end{array}\right]
\end{array}\right] \\
\text{LEX-DTR} & \left[\begin{array}{ll}
\text{PHON} & \left\langle \boxed{1} \right\rangle \\
\text{SYNSEM}|\text{LOC} & \left[\begin{array}{ll}
\text{CAT} & \left[\begin{array}{ll} \text{HEAD} & \textit{verb} \\ \text{ARG-ST} & \boxed{4} \end{array}\right] \\
\text{CONT} & \left[\begin{array}{ll} \text{IND} & \boxed{6}\ \textit{event} \\ \text{RELS} & \boxed{2} \\ \multicolumn{2}{l}{\textit{mrs}} \end{array}\right]
\end{array}\right] \\
\multicolumn{2}{l}{\textit{stem}}
\end{array}\right] \\
\multicolumn{2}{l}{\textit{ung-noun-drvtn-lr}}
\end{array}\right]$$

2. A new element is needed in the SPR list, since nouns need a specifier while verbs do not.

3. The former "subject" must be added to the COMPS list.

The items 1 and 2 in the list were already solved by the lexical rule in (31), but since the lexical rule did not constraint the COMPS list of the noun stem, the item 3 remained unsolved. The constraining of the COMPS list can be worked out by virtue of the mapping between the ARG-ST list and the VAL lists. Moreover, the ARG-ST list need to be reorganised considering the following aspects:

- The first element in the ARG-ST list must be the specifier.
- The second element in the ARG-ST list is the former subject, which should be now the first element of the COMPS list, if it is to be realised.
- The further elements in the ARG-ST must be the other elements of the former COMPS list.

As mentioned in FN 24 in Section 4.2, the elements in the VAL lists and in the ARG-ST are structure-shared. Structure sharing does not imply any ordering issues. That is to say, it implies neither that the elements of the ARG-ST list are filled in a specific order with the elements of the VAL lists (i.e. VAL → ARG-ST), nor the other way around, that the elements of the VAL lists are filled in a specific order with the elements of the ARG-ST list (i.e. ARG-ST → VAL). Structure sharing just implies that (some of) the elements of both lists are token identical, but not anything else. Nevertheless, when the ARG-ST feature is introduced, it is often mentioned that "[. . .] canonically the values of the various valence features [. . .] 'add up' to the argument structure of a given word" (Sag and Godard, 1994: 525). Moreover, it is also mentioned that "[. . .] the value of [. . .] ARG-ST is the list which is the result of appending (cf. '⊕') the lists being the values of SUBJECT, SPECIFIER and COMPLEMENTS, *in that order.* [Emphasis added; MyP]" (Przepiórkowski, 1999: 27). Przepiórkowski (1999: 24) mentions that this mapping takes place *in the unmarked case* (cf. too Richter 2000: 329). As mentioned in the list above for the ARG-ST list, I am going to argue that in the unmarked order

are modelled as having a specifier as well as a subject (cf. Pollard and Sag 1994: 359–362 and Wechsler 2015: 204).

– at least *for nouns* – the specifier precedes the subject, and both precede the complements.

The question about the direction of the mapping depends strongly on the theoretical treatment of the head-dependent relations, which were illustrated in detail in Section 3. For instance, if adjuncts are treated as elements able to appear in the COMPS list as assumed for instance by Bouma et al. (2001),[44] then the ARG-ST list will not contain elements which in fact are in a VAL list. Thus, the cardinality of the ARG-ST list will be equal or smaller than the one of the elements in VAL, and therefore an ARG-ST → VAL mapping will not be possible without further ado. On the other hand, if elements which are not syntactically realised, but are nevertheless counted among the arguments of a predicate (e.g. a demoted argument in passive, PRO and pro elements, etc.) are included in the ARG-ST list, though not included in the VAL lists (cf. Manning and Sag, 1998: 115), then the cardinality of the ARG-ST list will be equal or greater than the one of the elements in VAL, and a VAL → ARG-ST mapping will not be possible offhand. It is not necessary to posit a hard-wired generalisation about the direction of the mapping, but there are some tendencies. Here, I am assuming – in contrast to Sag and Godard (1994: 525) – a stronger tendency to the ARG-ST → VAL mapping. This is founded in theory internal facts and in facts resulting from the treatment of complementation. The former has to do with the assumption of a strong distinction between arguments and adjuncts not accounting for adjuncts as elements of one of the VAL lists (in contrast to Bouma et al. (2001)). The latter has to do with the behaviour of nominal arguments as complements rather than as subject and complements.

Therefore, the assumptions I am making here with respect to the ARG-ST attribute are the following ones:

- Although, the ARG-ST attribute is normally assumed to be relevant only for signs of type *word* (cf. for instance Przepiórkowski 1999: 24 and Bildhauer 2007: 14), I am assuming here that it is relevant for elements of type *non-phrase*, since argument-structural alternations can be found on word level as well as on root or stem level (cf. the ‘ung’-nominalisation given in (31)).[45]

[44] Bouma et al. (2001: 6–7) make use of a further attribute called DEPENDENTS (DEPS) which is a kind of extended argument structure containing also adjuncts.

[45] This fact has been worked out in different frameworks and not only in HPSG. See for instance Alexiadou and Schäfer (2010) for an account of ‘-er’ nominalisation in *Distributed Morphology* (DM) and Müller (2016b) for an account of argument-structural alternations in HPSG.

- The value of the ARG-ST attribute is not projected by means of a general principle, in comparison to the values of the VAL lists (cf. ValP).
- The ARG-ST list contains a list of all arguments of a head (as defined in Section 3.2.1) and its specifier (if available),[46] regardless of whether they have to be *overtly realised* or not.
- The unmarked order in the ARG-ST list is (at least for nouns): specifier > subject > complements.
- The mapping results *normally* from the elements of the ARG-ST list to the VAL lists.

There are two steps that have to be considered for the ARG-ST/VAL mapping. Firstly, it is important how the order of elements in the ARG-ST list is constrained, and secondly, how this order is reflected to the elements of the VAL lists. As it was mentioned in Section 4.2, the elements in the ARG-ST list are sometimes ordered by increasing syntactic obliqueness based on the *Accessibility Hierarchy* (cf. (17)) after Keenan and Comrie (1977: 66). Another way to order the elements in the ARG-ST list is according to a semantically grounded degree of obliqueness (cf. Manning and Sag, 1998: 123–124). That is, "[...] thematically more prominent arguments typically become core arguments and precede thematically less prominent arguments at argument structure [...]". This kind of generalisation which can be considered "[...] largely though not completely consistent across languages [...]" is implemented in the constraints for verbal lexemes. The following constraints in (32) adapted from Manning and Sag (1998: 124) should illustrate this.

The first implicational constraint on elements of type *verb-lxm* constraint the part-of-speech and the absence of a specifier (by virtue of the empty list).[47] The second implicational constraint for elements of type *subj-v-lxm*, inherits the constraint of *verb-lxm* and adds the statement that it must be only one element in the SUBJ list (abbreviated with $\langle \square \rangle$). The third and the fourth implicational constraints inherit both former constraints and add the ordering of elements in the

[46] As it was mentioned in Section 3.3, the treatment of specifiers is controversial. Though, I do not treat them as arguments, it is necessary to include them in the ARG-ST list. This fact enforces the ambivalent status of specifiers.

[47] The notation for the empty list is given sometimes with the angled brackets $\langle\rangle$, which is an equivalent short-cut for the type *elist*.

(32) Constraints on verbal lexemes (Manning and Sag, 1998: 124)

$$\textit{verb-lxm} \rightarrow \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{VAL}|\text{SPR} & \langle\ \rangle \\ \textit{cat} & \end{bmatrix}$$

$$\textit{subj-v-lxm} \rightarrow \textit{verb-lxm} \wedge \begin{bmatrix} \text{VAL}|\text{SUBJ} & \langle \square \rangle \\ \textit{cat} & \end{bmatrix}$$

$$\textit{intrans-v-lxm} \rightarrow \textit{subj-v-lxm} \wedge \begin{bmatrix} \text{ARG-ST} & \left\langle \text{NP}_{[\textit{core}]} \right\rangle \oplus \textit{list}(\textit{obl-np}) \\ \textit{cat} & \end{bmatrix}$$

$$\textit{trans-v-lxm} \rightarrow \textit{subj-v-lxm} \wedge \begin{bmatrix} \text{ARG-ST} & \left\langle \text{NP}_{[\textit{core}]},\ \text{NP}_{[\textit{core}]} \right\rangle \\ \textit{cat} & \end{bmatrix}$$

ARG-ST list. For intransitive verb lexemes, it states that the first element of the ARG-ST list must be a *core* element, followed by a list of oblique NPs.[48] Which elements are "more core" than others and how the oblique NPs are ordered with respect to each other is a matter of theta-role hierarchies (or other kinds of ordering semantic obliqueness) and further constraints on verb-classes, types of eventualities, etc. I am not going into the details of the theta-role hierarchies, since this is not the topic of the present work.[49] Let us assume for the sake of the argument, that there is some kind of ordering of semantic roles as it is provided in a very simplistic form in (32). With respect to nouns, we have to consider the specifier as well. An ordering SUBJ-SPR-COMPS would be misleading from a semantic as well as from a syntactic point of view of obliqueness. Syntactically seen, it can be said, that subject and complements belong to a natural class, with both being normally NPs, while specifiers are determiners or DPs – at least for nouns. On the semantic side, specifiers behave differently from ordinary arguments, since the interpretation

[48] The notation *list*(*obl-np*) describes a parametrised list. That is, a list of objects of the type given by the parameter, in this case, a list of objects of type *oblique-np* (cf. Przepiórkowski, 1999: 18). Parametrised lists are defined in the signature as containing elements of a particular kind (cf. Richter, 2000: 137).

[49] For discussions on this topic, see Dowty (1991); Wechsler (1991); Baker (1997); Davis and Koenig (2000); a.o.

of the noun is dependent on the specifier and not the other way around as it was shown in the discussion of the SemP (cf. (54) in Section 3.3.2). Thus, the ARG-ST of nouns should reflect the ordering SPR-SUBJ-COMPS.

Now, (32) tells us nothing about the *mapping* between VAL and ARG-ST. Manning and Sag (1998: 125) propose what they call *realisation types*, that is, types which reflect generalisations about the mapping between the argument-structure and the valence lists (cf. (33)).

(33) Realisation types for verbal lexemes (Manning and Sag, 1998: 125)

$$\textit{acc-canon-lxm} \rightarrow \begin{bmatrix} \text{VAL} & \begin{bmatrix} \text{SUBJ} & \left\langle \boxed{1} \right\rangle \\ \text{COMPS} & \boxed{2} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1} \right\rangle \oplus \boxed{2} \\ \textit{subj-v-lxm} & \end{bmatrix}$$

$$\textit{erg-canon-intrans-lxm} \rightarrow \begin{bmatrix} \text{VAL} & \begin{bmatrix} \text{SUBJ} & \left\langle \boxed{1} \right\rangle \\ \text{COMPS} & \boxed{2} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1} \right\rangle \oplus \boxed{2} \\ \textit{intrans-v-lxm} & \end{bmatrix}$$

$$\textit{erg-canon-trans-lxm} \rightarrow \begin{bmatrix} \text{VAL} & \begin{bmatrix} \text{SUBJ} & \left\langle \boxed{1} \right\rangle \\ \text{COMPS} & \left\langle \boxed{4} \right\rangle \oplus \boxed{2} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{4} \right\rangle \oplus \left\langle \boxed{1} \right\rangle \oplus \boxed{2} \\ \textit{trans-v-lxm} & \end{bmatrix}$$

The realisation types in (33) adapted from Manning and Sag (1998: 125) refer to the constraints on verbal lexemes given in (32), and relate the elements of the ARG-ST list to the elements in the VAL lists. For instance, for verbal lexemes which are canonically nominative-accusative, the type *acc-canon-lxm* will take the constraint for *subj-v-lxm*,[50] which states that there is no specifier and only one subject, and add the constraint that the first element in the ARG-ST list is an element of the SUBJ list. That is to say, the thematically most prominent element is realised as subject,

[50] I am assuming here that *subj-v-lxm* is the supertype of *intrans-v-lxm* and *trans-v-lxm*. Therefore, by virtue of inheritance, *acc-canon-lxm* will take one of both subtypes for the constraint.

while the further elements are realised as complements. For verbal lexemes which are ergative, there is – as is well known – a difference in the mapping if they are transitive or intransitive. While ergative intransitive verbs (*erg-canon-intrans-lxm*) map the first element of the ARG-ST list to the SUBJ list, and the rest to COMPS, ergative transitive verbs (*erg-canon-trans-lxm*) map the first element of the ARG-ST list to the COMPS list, the second element of the ARG-ST list to SUBJ, and the further elements to COMPS. Thus, the realisation types take the constraints given by the lexemes and map the elements from ARG-ST to the VAL lists.

Now, I am going to use this reasoning for nominal stems, and return to our lexical rule for the -*ung*-nominalisation in (31), in order to solve the mapping problem for nouns. Firstly, I present the constraints on nominal stems[51] in (34).

(34) Constraints on nominal stems

$$\textit{noun-stem} \rightarrow \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textsc{ini} & + \\ \textit{noun} & \end{bmatrix} \\ \textit{cat} & \end{bmatrix}$$

$$\textit{prd-n-stem} \rightarrow \textit{noun-stem} \wedge \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textsc{prd} & + \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{spr} & \langle \square \rangle \\ \textsc{subj} & \langle \square \rangle \end{bmatrix} \\ \textit{cat} & \end{bmatrix}$$

$$\textit{nonprd-n-stem} \rightarrow \textit{noun-stem} \wedge \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textsc{prd} & - \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{spr} & \langle \square \rangle \\ \textsc{subj} & \langle\, \rangle \end{bmatrix} \\ \textit{cat} & \end{bmatrix}$$

$$\textit{arg-nonprd-n-stem} \rightarrow \textit{nonprd-n-stem} \wedge \begin{bmatrix} \textsc{arg-st} & \langle \mathrm{DP} \rangle \oplus \textit{list}(\textit{str-np}) \oplus \textit{list}(\textit{obl-np}) \\ \textit{cat} & \end{bmatrix}$$

$$\textit{nonarg-nonprd-n-stem} \rightarrow \textit{noun-stem} \wedge \begin{bmatrix} \textsc{arg-st} & \langle \mathrm{DP} \rangle \\ \textit{cat} & \end{bmatrix}$$

[51] I am choosing here the term *stem* over *lexeme*.

The first constraint on elements of type *noun-stem* specifies its part-of-speech and the INI value as explained in Section 2.5.4. The second and third constraints deal with elements of type *predicative-noun-stem* (*prd-n-stem*) and *non-predicative-noun-stem* (*nonprd-n-stem*). As it was mentioned in Footnote 43, while non-predicative NPs have only a specifier, predicative NPs are assumed to have a subject as well as a specifier (cf. Pollard and Sag 1994: 360–362; Müller 2009: 225; a.o.).[52] The last type presented, *arg-nonprd-n-stem* provides the ordering of elements inside the ARG-ST list for non-predicative NPs (cf. the conjunction with the type *nonprd-n-stem*). The first element of the list is a list containing only one DP element. The second element is a parametrised list, the parameter states that the elements of this list must be NPs with structural case. The third element is also a parametrised list of elements which have oblique case (i.e. lexical case). Since the type *list* is a supertype for *nelist* and *elist*, if for instance a noun stem does not have any elements with structural case, then the *list*(*str-np*) will be empty. That is, it will be of the subtype *elist*, [53] leaving at the end only a list with the DP element and the list of oblique NPs.

Now, as it was the case with the constraints on verbal lexemes in (32), the constraints on noun stems do not reveal so much about the ARG-ST → VAL mapping. This mapping can be accounted for by the realisation type shown in (35).

(35) Realisation types for non-predicative nominal stems

$$\textit{arg-rln-nonpred-n-stem} \rightarrow \begin{bmatrix} \text{VAL} & \begin{bmatrix} \text{SPR} & \left\langle \boxed{1} \right\rangle \\ \text{COMPS} & \left\langle \text{member}(\boxed{2}) \right\rangle \oplus \boxed{3} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1} \right\rangle \oplus \boxed{2}\ \textit{list}(\textit{str-np}) \oplus \boxed{3}\ \textit{list}(\textit{obl-np}) \\ \textit{arg-nonprd-n-stem} & \end{bmatrix}$$

The constraint for argument realisation in non-predicative nominal stems (*arg-rln-nonpred-n-stem*) states that the first element of the ARG-ST list, i.e. the DP as stated in the constraint for *arg-nonprd-n-stem* in (34), is structure-shared with the value of the SPR list (cf. $\boxed{1}$ in (35)). Furthermore, it determines that in case that

[52]The PREDICATIVE (PRD) attribute is introduced in the literature as a HEAD feature. PRD is *bool* valued. I am not considering predicative NPs for now, but their type has been introduced here, because the difference in the VAL list between both types is relevant.

[53]This treatment of the ordering of elements in the ARG-ST list should not be confused with the treatment of optional arguments in NPs. See Section 4.4.

there is a list of oblique NPs – i.e. *list*(*obl-np*) is not an *elist* – its elements will be the last elements in the COMPS list.

The most interesting part of the constraint – and the solution to the problem I am aiming to solve here – concerns the first element of the COMPS list. The particular challenge stated by nominals was that although more than one element in the ARG-ST list can have structural case, at most one of them can be overtly realised. This problem is solved here with the functional counterpart of the relational constraint `member` (cf. Richter, 2000: 135).

The relational constraint `member` as a *relation* takes two arguments: an element and a list (cf. example (36a)) and states between both arguments the existence of a "member-of" relation. That is, it states that the constraint is true iff the element (cf. x in (36a)) is an element of this list.[54] The functional counterpart of `member` has only one argument, the list (cf. (36b)), and delivers a single member of this list as a result.

(36) a. `member` $(x\ ,\ \langle \ldots\ x \ldots \rangle)$ [relation]

b. `member` $(\langle \ldots\ x \ldots \rangle) = x$ [function]

The `member` relation and the `member` function are completely equivalent. For the sake of clarity, I am using the latter in the constraint (35). There, ⟨`member` ($\boxed{2}$)⟩ means "a single member of the list $\boxed{2}$". Thus, only one element of the list of NPs with structural case will be realised as an element of the COMPS list, while all arguments of the noun are still included in its ARG-ST list, and therefore, although not syntactically realised, at least semantically implied and available for other relations, e.g. for binding if necessary. Please note that the `member` constraint does not account for the fact that all arguments in NPs are optional. It only accounts for the fact that at most one argument with structural case can be realised. The case of optionality will be discussed in Section 4.4.

The analysis proposed here gives in addition further evidence for the grouping of elements with structural case in one single list, and not for the division of the subject and complements by the specifier in the ARG-ST list. That is to say, the unmarked order of elements in the ARG-ST list of nouns is: specifier > subject > complements with structural case > oblique complements.

[54] A notational short-cut for the `member` constraint is $\langle \ldots \boxed{0} \ldots \rangle$. In this notation, it is stated that $\boxed{0}$ is a single member of the list. Since we are using parametrised lists we would need to extend the short-cut to $\langle \ldots \boxed{0} \ldots \rangle_{str\text{-}np}$.

4.3.2 Case marking

With the solution just proposed in the last section, case marking in NPs can be solved straightforwardly by means of the CaseP presented in (21). Namely, all elements in the ARG-ST list of a noun with structural case (which are not raised) bear structural genitive. A modification of the CaseP is therefore not necessary to account for the fact that only one constituent with structural case can appear. To solve this issue, we only need to constrain the mapping between ARG-ST and VAL.

Furthermore, unlike the Case-Filter in MGG (cf. Section 4.2) which implies a relation between case assignment and the "visibility" of a constituent[55] by proposing that every phonetically realised NP must bear (abstract) "Case" (cf. Chomsky, 1981: 49), the present account does not need to make this implication. Moreover, since the CaseP in this account regulates the case value of the elements in the ARG-ST list, elements which are not realised can be nevertheless considered as "bearing case". Whether elements are realised or not, is in our account a matter of the ARG-ST to VAL mapping and of the constraining of the VAL lists which is a more natural relation than the relation between a syntactic feature – viz. case – and a phonetic form.

One issue which has been left open until now, concerns the actual case marking of NPs. While German NPs are marked morphologically, as it was shown in Table 4.1, Spanish NPs are marked by means of (dummy) prepositions, i.e. syntactically (cf. Table 4.2). This implies that in both languages different resources for case marking must be used: a morphological one for the former, and a syntactic one for the latter. In the following Sections 4.3.3 and 4.3.4, both systems will be sketched.

4.3.3 Morphological case marking

In the literature, it is commonly assumed that German nouns vary according to case and number. Furthermore, the values of their person, gender and declension class features are considered as inherent.[56] According to that, it is not possible to

[55] For instance in GB, the direct object in a passive sentence must move from the VP internal position to the specifier of the IP in order to get case and be thus able to be theta-marked (cf. Chomsky 1981: 170–183 and Haegeman 1994: 188–192).

[56] See for instance, Schäfer (2016: 265).

vary the values of a noun's person[57], gender, or declension class attributes. For instance, if a noun has the GEND value *masc*, it is not possible to *inflect* it to a feminine noun (cf. example (38a)).

(37) der Tisch vs. *die Tisch
the.M table the.F table

However, it is indeed possible to change the gender value of a noun from masculine to feminine (cf. example (38a)) or the other way around (cf. example (38b)), though this is not achieved by means of *inflection*, but of *derivation* (cf. Krifka, 2009: 157).

(38) a. der Lehrer vs. die Lehrer-in
the.M teacher the.F teacher-F

b. die Ente vs. der Ente-rich
the.F duck the.M duck-M

Though nouns cannot be inflected for person (cf. Footnote 57), gender, and declension class, at least gender and declension class are attributes which play a role in the way nouns are inflected. The inflectional paradigm of nouns is dependent on their gender and declension class values as shown in Table 4.3 for *Arzt* 'doctor', *Patient* 'patient', *Staat* 'state', *Kind* 'child', *Ohr* 'ear', and *Frau* 'woman'.

		MASCULINE			NEUTER		FEMININE
		STRONG	WEAK	MIXED	STRONG	MIXED	
SG	NOM	Arzt	Patient	Staat	Kind	Ohr	Frau
	ACC	Arzt	Patient-en	Staat	Kind	Ohr	Frau
	DAT	Arzt	Patient-en	Staat	Kind	Ohr	Frau
	GEN	Arzt-es	Patient-en	Staat-es	Kind-es	Ohr-(e)s	Frau
PL	NOM	Ärzt-e	Patient-en	Staat-en	Kind-er	Ohr-en	Frau-en
	ACC	Ärzt-e	Patient-en	Staat-en	Kind-er	Ohr-en	Frau-en
	DAT	Ärzt-en	Patient-en	Staat-en	Kind-ern	Ohr-en	Frau-en
	GEN	Ärzt-e	Patient-en	Staat-en	Kind-er	Ohr-en	Frau-en

Table 4.3: Nominal inflection in German

German has three possible gender values: *masc*, *neut*, and *fem*,[58] and three

[57] In Section 4.6, I am going to give evidence for the fact that the PER value of nouns is underspecified.

[58] I will not go into the details of the German gender system. For further remarks, see Fries (2008) and especially with respect to case syncretism in German feminines, see Krifka (2009).

possible values for declension class: *strong*, *weak*, and *mixed*.[59] Masculine nouns can have the DECL value *strong* as *Arzt* 'doctor', *weak* as *Patient* 'patient', or *mixed* as *Staat* 'state'. The singular paradigm of *strong* nouns varies only in the genitive form which is built with the affix -*es*. The plural paradigm of *strong* nouns is built with a plural affix, e.g. -*e*, and the word-form in dative is built with -*en*. On the contrary, the singular paradigm of *weak* nouns has the affix -*en* for all cases except for the nominative. Furthermore, the plural paradigm for the *weak* class is built with the affix -*en* as is the singular paradigm. Masculine nouns which belong to the *mixed* class behave in the singular paradigm like the *strong* class and in the plural paradigm like the *weak* class. Neuter nouns belong either to the *strong* class (e.g. *Kind* 'child') or to the *mixed* class (e.g. *Ohr* 'ear'). For the feminine nouns normally the declension classes are not relevant.[60]

Table 4.3 makes clear that in order to capture generalisations with respect to the inflection paradigm of nouns in German, it is necessary to account for the interaction of number, case, gender, and declension class. First of all, since the declension class is an inherent feature of nouns, it must be encoded in the AVM of a noun stem to which class it belongs. DECL is a head feature and has a value of type *decl*. The type *decl* has different subtypes for every parts of speech. For instance, verbs are classified as well according to the declension classes *strong*, *weak*, and *mixed* (cf. Figure 4.2).

The nominal declension class (*n_decl*) has several noun specific subtypes which are sometimes a combination of number and declension class, e.g. *n_sg_strong*, *n_pl_strong*, *n_sg_weak*, and *n_pl_weak*.[61] These four combinations of number and declension class yield three subtypes by multiple inheritance: *n_strong*, *n_mixed*, and *n_weak*, with the particular characteristic (cf. Table 4.3) that the mixed class for nouns behaves in the singular paradigm like the strong class, and in the plural paradigm like the singular one. Therefore, a noun stem such as *Staat* 'state' will

[59] The traditional classification of declension classes into *strong*, *weak*, and *mixed* dates back to the work of Jacob Grimm. Netter (1994: 305) accounts for the paradigm of nouns in German only with two values for the attribute DECLENSION-CLASS (DECL): *strong* and *weak*. I am not working out the details here, since I only want to show how morphological case is assigned. See Pollard and Sag (1994: 371–374).

[60] For a more detailed description of inflection in German, see Schäfer (2016: 265–276). For the sake of clarity, I am giving only a sketch here.

[61] Due to lack of space, I am going to disregard the feminine inflection (*fem-infl*) and further declension classes as the s-inflection (*s-infl*) like in *Auto–Autos*.

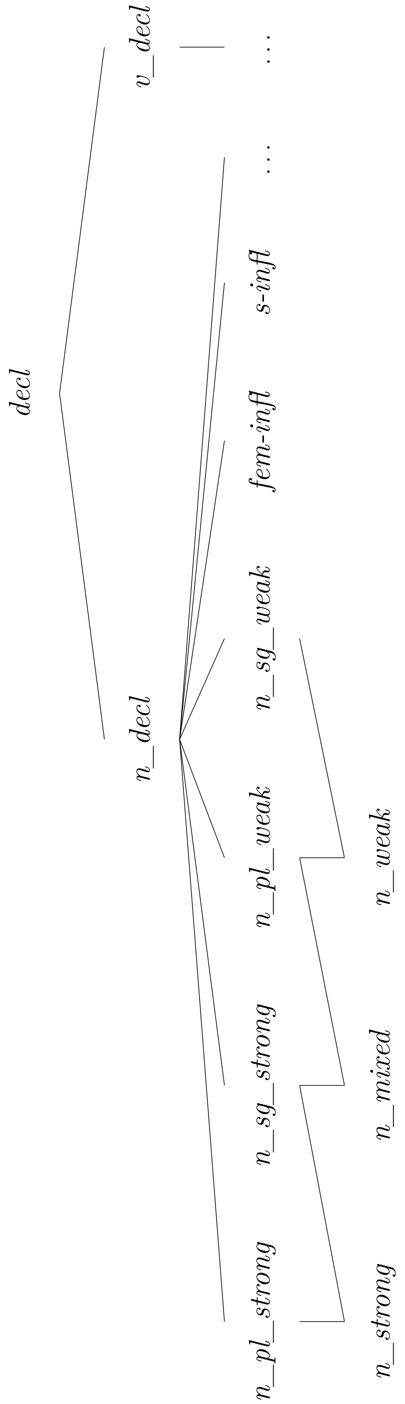

Figure 4.2: Type hierarchy for declension class

have the lexical entry given in AVM (39).

(39)
$$\begin{bmatrix} \textsc{phon} & \left\langle \textit{Staat} \right\rangle \\ \textsc{synsem}|\textsc{loc} & \begin{bmatrix} \text{CAT}|\text{HEAD} & \begin{bmatrix} \text{DECL} & \textit{n\_mixed} \\ \textit{noun} & \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{1} \begin{bmatrix} \text{PER} & \textit{3} \\ \text{GEND} & \textit{masc} \\ \textit{ref} & \end{bmatrix} \\ \text{RELS} & \left\langle \begin{bmatrix} \text{INST} & \boxed{1} \\ \textit{state} & \end{bmatrix} \right\rangle \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\ \textit{stem} & \end{bmatrix}$$

Since (39) represents a stem, it has no case and number information, only the inherent information is specified. By virtue of the constraints on nominal stems in Figure (34) information about the INI value and the ARG-ST is inherited. Since *Staat* is a noun without arguments it would be of type *nonarg-nonprd-n-stem* – in case it is used non-predicatively. Now, in order to get an object of type *word* specified for case and number out of the stem (39) a lexical rule must be used (cf. (40)).

The lexical rule *es-noun-infl-lr* in (40) takes a nominal stem as LEX-DTR which is specified as *n_sg_strong*, since *Staat* has the DECL value *n_mixed* which is a subtype of *n_sg_strong*, the stem in (39) and the lexical rule in (40) are unifiable. Furthermore, the lexical rule constraints that the stem must be either masculine or neuter. The actual value of the stem will be structure-shared with the result of the rule (cf. $\boxed{4}$). The case and number values are contributed by the affix *-es*, more specifically by the lexical rule. The case *gen* as shown in Figure 4.1 is a supertype for structural as well as for lexical genitive, thus this rule licenses objects which are underspecified with respect to *str_gen* or *lx_gen*. With this one lexical rule the word-forms *Arztes* '(of the) doctor', *Staates* '(of the) state', *Kindes* '(of the) child', and *Ohrs* '(of the) ear' can be licensed, since it is applicable to masculine strong and mixed, and neuter strong and mixed noun stems.

(40) Lexical Rule: -*es*-Inflection

$$
\begin{bmatrix}
\text{PHON} & f(\boxed{1}\,, \langle \text{-}es \rangle) \\
\text{SYNSEM}|\text{LOC} & \begin{bmatrix}
\text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{DECL} & \boxed{2} \\ \text{CASE} & gen \\ noun & \end{bmatrix} \end{bmatrix} \\
\text{CONT} & \begin{bmatrix} \text{IND} & \begin{bmatrix} \text{PER} & \boxed{3} \\ \text{NUM} & sg \\ \text{GEND} & \boxed{4} \end{bmatrix} \end{bmatrix}
\end{bmatrix} \\
\text{LEX-DTR} & \begin{bmatrix}
\text{PHON} \ \langle \boxed{1} \rangle & \\
\text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{DECL} & \boxed{2}\ n\_sg\_strong \\ noun & \end{bmatrix} \\ \text{CONT}|\text{IND} & \begin{bmatrix} \text{PER} & \boxed{3}\ \mathit{3} \\ \text{GEND} & \boxed{4}\ masc \vee neut \end{bmatrix} \end{bmatrix} \end{bmatrix} \\
stem &
\end{bmatrix} \\
es\text{-}noun\text{-}infl\text{-}lr &
\end{bmatrix}
$$

4.3.4 Syntactic case marking

In contrast to the morphological case marking in German, Spanish nouns are not inflected for case, but their case is marked by means of prepositions, as shown in Table 4.2 – repeated and completed here as Table 4.4.

		EL DOCTOR: MASC		ÉL: MASC		CL: MASC
SG	NOM	el	doctor		él	∅
	ACC	a-l	doctor	a	él	lo
	DAT	a-l	doctor	a	él	le
	GEN	de-l	doctor	de	él	∅
PL	NOM	los	doctor-es		ellos	∅
	ACC	a los	doctor-es	a	ellos	los
	DAT	a los	doctor-es	a	ellos	les
	GEN	de los	doctor-es	de	ellos	∅

Table 4.4: Case paradigm in singular and plural (Spanish)

In Table 4.4, the paradigms of a masculine noun with its definite determiner *el doctor* 'the doctor', a masculine personal pronoun *él* 'he', and a masculine clitic pronoun are given. Case marking for NPs and pronouns is achieved by means of the prepositions *a* for accusative and dative, and *de* for genitive. The nominative form stays unmarked. In comparison to German, where an interaction of case, number, gender, and declension class had to be accounted for (cf. Table 4.3), in Spanish the marking is consistent for case and does not interact with the other factors.[62]

What seems to be morphological marking in the singular paradigm of determiners, i.e. the forms *al* and *del*, are just phonetic contractions of preposition and article, since these articles are not accented and begin with a vowel. In contrast, there is no contractions with articles beginning with a consonant (cf. *a los*), and with accented pronouns (cf. *a él*). The only real morphological variation with respect to case is given in the paradigm of clitic pronouns which vary in accusative and dative, and does not have word-forms for nominative and genitive.

I am going to concentrate on the mechanisms to achieve the syntactic marking in comparison to the morphological one seen in the last section. In order to do so, I

[62] As already mentioned, the case marking in accusative interact in fact with *semantic* factors such as: definiteness, animacy, and specificity. See Machicao y Priemer (2014) for an overview of the factors. For a similar phenomenon in Persian and English and an account by means of pseudo-incorporation, see Krifka and Modarresi (2016).

will firstly show – following Bresnan (1982); Demonte (1987); Machicao y Priemer (2010: 15–23); a.o. – that the elements used to mark case are not prepositions, but only semantically vacuous elements with the same form as prepositions, but with a different function (cf. Section 4.3.4.1). Secondly, in Section 4.3.4.2, I will give a characterisation of these vacuous elements as markers, following Pollard and Sag (1994: 44–46); Badia (1998); a.o. To conclude, I will show in Section 4.3.4.3 how syntactic case marking can be accounted for in HPSG.

4.3.4.1 (Dummy) Prepositions

The question whether the elements marking case in Spanish are real prepositions or elements of another kind is an important issue, since both assumptions influence the kind of ID-schema which has to be used for the combination of the (alleged) preposition and the NP (cf. Figures 4.3 and 4.4), and must be solved before giving any account of syntactic case marking.

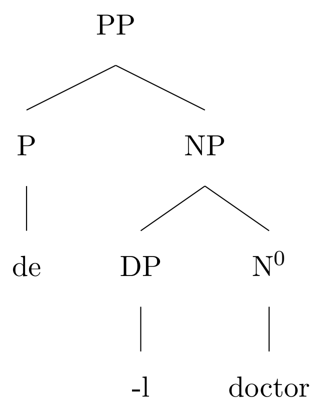

Figure 4.3: PP structure

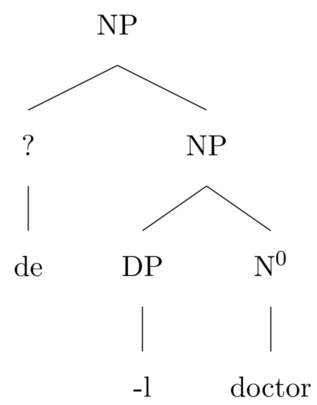

Figure 4.4: NP structure

In comparison to older analyses in which PPs were analysed as exocentric,[63] in newer accounts the preposition is treated as the head (cf. Wunderlich 1984; Fries 1988a: 29–31; a.o.). Thus, given what has been said in Section 3.1 about heads, the entire phrase must be considered as a PP if the element which is marking case is treated as a real preposition (cf. Figure 4.3). But, in many languages, prepositions show a tendency to develop into case markers (cf. Haspelmath 2009: 506–507),

[63] See for instance Bloomfield (1933: 194–195). For a discussion in Valence Theory about PPs as complements of NPs and prepositions as governors of NPs, see Ágel (2000: 56–59).

grammaticalising their semantic and syntactic behaviour and thus becoming functional, rather than lexical, elements (cf. Figure 4.4).[64] Therefore, the first question we have to face is whether the preposition is going to be treated as a head or not. I am going to give some diagnostics to show that the preposition for genitive is *not* the head of the phrase.[65]

Considering these prepositions as heads of the phrase would have severe consequences for example for subcategorisation. A verb selecting an object in dative, for instance, would need to have two different subcategorisation lists: one for an NP (e.g. for a clitic pronoun without marker) and one for a PP, since full NPs in genitive and dative always bear the marker.

Furthermore, real prepositions are normally meaningful and assign a theta-role to their complements. For instance in example (41a) the interpretation of *Luisa* as accompaniment or not is triggered by the prepositions *con* 'with' and *sin* 'without', respectively. On the other hand, in example (41b) the interpretation of *Luisa* as agent or as patient is not triggered by the preposition *de* but directly by the noun.[66]

(41) a. el tratamiento con / sin Luisa
the treatment with / without Luisa
'the treatment with/without Luisa'

b. el tratamiento de Luisa
the treatment of Luisa
'the treatment of Luisa'

As mentioned before, NPs with structural case get their specific case value assigned in a particular syntactic context. This was exemplified in Section 4.2 by passivisation. In Section 4.3.1, the analogy between passivisation and nominalisation was described. Interestingly, the elements bearing structural cases nominative

[64] See Fries (1988a: 30–38) and Fries (1991) for German and Greek prepositions; Jiménez Juliá and Doval Reixa (2014) for a comparison of Latin, Spanish, and German prepositions; and Company Company (2006), Laca (2006), and Machicao y Priemer (2010: 24–37) especially for the Spanish preposition *a*.

[65] See Demonte (1987) and Machicao y Priemer (2010: 15–23) for the diagnostics with respect to the preposition *a*.

[66] The lexical elements *a* and *de* in Spanish are not only used with a case marking function. They also have many "homonyms" which act as real prepositions, for example *a* with the local and temporal meanings 'to', and *de* meaning 'origin' similar to 'from'. This fact makes their classification very fuzzy. See for instance Badia (1998: 110) for a similar statement with respect to prepositions in Catalan.

and accusative in a sentence, ended up bearing (structural) genitive in the nominal structure. See for instance *Luisa* with nominative in example (42a), or with accusative in example (42b) which can be interpreted parallel to the element with genitive in example (41b). But the phrase *de Luisa* in (41b) cannot be interpreted as being parallel to *con Luisa* in example (42c). That is to say, there is a structural relation between the nominative and accusative in (42a) and (42b) and the genitive in (41b), and this relation does not hold for real PPs since they are oblique and their formal marking and their interpretation are led by the prepositions.[67]

(42) a. Luisa trata a-l paciente.
Luisa.NOM treats a-the.ACC patient
'Luisa treats the patient.'

b. El doctor trata a Luisa.
the doctor treats a.ACC Luisa
'The doctor treats Luisa.'

c. El doctor trata a-l paciente con Luisa.
the doctor treats a-the patient with Luisa
'The doctor treats the patient with Luisa.'

Furthermore, according to Bresnan (1982: 351–352), "subjects" and "objects" of a predicate are semantically unrestricted with respect to the theta-roles they can bear. Their interpretation depends on the theta-roles the predicate is able to assign. In contrast, more oblique objects such as PPs are semantically restricted, that is, the interpretation of NPs inside a PP is determined by the preposition. Following Bresnan (1982: 401), oblique objects cannot be controllers, but non-oblique objects can. This asymmetry reflects the distinction between real, that is meaningful and syntactically stable ones, and dummy prepositions, that is vacuous and syntactically functional ones. The examples in (43a) and (43b) show this behaviour.

(43) a. * Mi diálogo con Fernando$_i$ alcoholizado$_i$ fue una catástrofe.
my dialogue with Fernando boozed was a catastrophe
'My conversation with Fernando while he was boozed was a catastrophe.' [intended reading]

[67] Take into account that nominative, accusative, and genitive can also be lexical cases, see Figure 4.1 and Footnote 22 in Section 4.2.

b. Mi tratamiento de Fernando$_i$ alcoholizado$_i$ fue una catástrofe.
my treatment of Fernando boozed was a catastrophe
'My treatment of Fernando while he was boozed was a catastrophe.'

In (43a) the predicate *alcoholizado* 'boozed' cannot be controlled by *Fernando* which is in a PP. But in (43b), *Fernando* in fact can control the predicate *alcoholizado* 'boozed' which leads to the conclusion that *de* – in this context (see Footnote 66) – is not to be treated as a real preposition, while *con* should be (cf. Zubizarreta 1985 and Demonte 1987 as well).

These diagnostics suggest that case marking prepositions in Spanish[68] should not be treated as real prepositions and therefore not as heads in phrases of type *head-complement-structure* with the NP as their complements (cf. Figure 4.3).

One of the few accounts for Spanish NPs in HPSG has been provided by Kirchner (1999). He proposes two lexical entries for the preposition *de* in Spanish: one which appears in verbal contexts and is semantically vacuous, and the other which appears in nominal contexts and is meaningful (cf. Kirchner, 1999: 248–252). As shown in the past examples, this division is too rough, and to some extent superficial. Firstly, example (41b) shows *de* in a nominal context. The ambiguous interpretation of the NP cannot be explained by assuming the preposition to be meaningful, since the theta-role of the NP *Luisa* must be assigned by the head noun which governs the preposition (i.e. *tratamiento*).

Further evidence is provided by example (44) which shows *de* in verbal contexts (viz. governed by a verb).

(44) a. Felicitas viaja *de* Berlin a Constanza.
Felicitas travels of Berlin to Konstanz
'Felicitas travels from Berlin to Konstanz.'

b. Su trabajo depende *de* la campaña electoral.
his job depends on the campaign electoral
'His job depends on the electoral campaign.'

In example (44a), *de* behaves as a meaningful element referring to the origin of the trip, and in (44b) as semantically vacuous, just marking the NP *la campaña electoral* as dependent on the verb. Similarly, *de* in nominal contexts can behave as a vacuous element (cf. (41b)) as well as a meaningful preposition (cf. (45)), so for

[68]See Machicao y Priemer (2010: 15–23) for the analysis of the *a*-marker for accusative and dative in Spanish and Badia (1998) for a similar treatment for dative in Catalan.

instance in the following examples the preposition *de* can be used as 'at', 'from', 'belonging to', or 'made from'.[69]

(45) a. el viaje *de* noche
the trip at night

b. el viaje *de* Puerto Rico
the trip from Puerto Rico

c. el dinero *de* mi padre
the money belonging to my father

d. el dinero *de* papel
the money made from paper

That *de* can state different kinds of relations does not imply that *de* in (45) is vacuous and only marks the syntactic dependency relation between two nouns. On the contrary, if this would be the case, it would not be clear in (45b) if the trip was *from* or *to* Puerto Rico, or in (45c) if the money *belongs to* or *is for* my father. The examples in (45) show meaningful prepositions whose meanings can be related in some way to each other, and which show a kind of gradual grammaticalisation.

To sum up, in nominal as well as in verbal contexts, not only meaningful but also vacuous prepositions can be found – in contrast to what has been proposed by Kirchner. Thus, as remarked in Footnote 66, it must be proposed that the (vacuous) case marking prepositions have meaningful homonyms. Therefore, I agree with the proposal of Kirchner (1999) (among many others) to distinguish *de* (and this holds for many but not all prepositions) as a semantically vacuous *marker*, and *de* as a meaningful *preposition*. However, I disagree with his proposal that this distinction correlates with the environment *de* occurs in, that is in verbal environments as a semantically vacuous preposition and in nominal contexts as a meaningful one.

4.3.4.2 Markers

It follows from what has been discussed so far that the distinction between meaningful and vacuous prepositions is relevant in order to determine which element is the structural head, and therefore, which kind of structure we are dealing with

[69] As a side note, it is not quite clear what Kirchner (1999: 249–250) means with "semantically vacuous" and "meaningful" ('semantisch leer' and 'semantisch vollwertig' in his words). See for instance his examples on pages 249–250.

(cf. Figures 4.3 and 4.4 on page 161). This is the reason for me to take event nominalisations as examples, since for them the status of the preposition *de* is obvious, with it behaving only as case markers according to the diagnostics just presented.

Now, if the element *de* – when it is used as a case marker – is *not* a preposition, and the whole phrase is *not* a PP, then the question remains: What kind of object is *de*, and what kind of phrasal type are we dealing with? In Pollard and Sag (1994: 44–46) the category *marker* is proposed for such functional/grammatical objects which do not behave as heads, and do not have a semantic contribution to the phrase. In addition, Pollard and Sag (1987: 65) state the possibility to treat some "case-prepositions" as markers has been mentioned, but not worked out. In addition, in Pollard and Sag (1994: 45), the possibility to analyse "[...] perhaps nonpredicative adpositions in (the vast majority of) languages where adposition stranding does not occur"[70] as markers was stated. According to Pollard and Sag (1994: 45),

> "[...] a marker is a word that is 'functional' or 'grammatical' as opposed to substantive [≈ lexical categories; MyP], in the sense that its semantic content is *purely logical* in nature (perhaps *even vacuous*). [Emphasis added; MyP]"[71]

Elements such as the complementisers *that* and *for*, the comparative elements *than* and *as*, the semantically vacuous pre-field pronoun *es* 'it' in German (cf. Müller, 1999: 54–55), inflectional affixes (cf. Van Eynde, 1994), and some vacuous prepositions in Catalan (cf. Badia, 1998) have been proposed.[72] to be members of the category marker, which is technically speaking a new part of speech – viz. *marker* is a subtype of *pos* (cf. Pollard and Sag, 1994: 45).

[70] To this statement, I would add "as far as they are semantically vacuous".

[71] It is actually not trivial to make a distinction between markers with (logical) meaning and markers that have no meaning at all. It depends on this assumption how the meaning of markers is projected to the phrase, i.e. which part of the SemP must apply to the *head-marker-structure* or whether a new clause in the SemP is needed. Treating markers as elements with functional meaning evokes a certain similarity between markers and specifiers, and probably a supertype for phrases of type *head-marker-structure* and *head-specifier-structure* in the type hierarchy of sign (cf. Figure 3.8) must be worked out (cf. Van Eynde 2006 for similar account).

[72] See Kiss (1995: 188–195) for arguments against the marker-treatment of complementisers such as *dass* 'that' in German, and Müller (2013a: 399–400) for arguments against the treatment of inflectional affixes as markers.

The arguments for the marker class are not only of semantic nature alluding to the empty content of some elements. Arguments of syntactic nature have been offered as well. In particular, Pollard and Sag (1994: 44) argue on the basis of the contrast in example (46) (their (34)) that the Locality Principle would be violated by treating *that* as the head of the subordinate clause.

(46) a. I demand [*that* he *leave* immediately].
b. * I demand [*that* he *leaves* immediately].

MGG approaches analyse the complementiser as the head of the phrase in brackets – which is treated as a CP in MGG accounts (cf. Chomsky 1986; Haegeman and Ürögdi 2010b; a.o.). Since HPSG is a framework which builds on strict locality (cf. Pollard and Sag, 1987: 143–145), a structure such as the one presented in Figure 4.5 presents a problem.

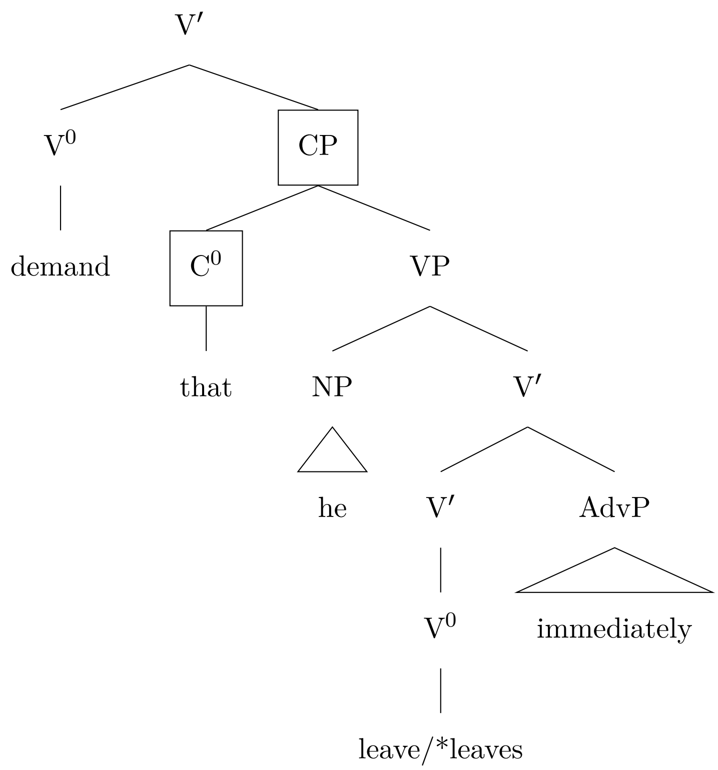

Figure 4.5: *that* as head

The problem presented in example (46) and Figure 4.5 is that, taking *that* as the head of the phrase (in this case a CP), the verb *demand* selects a *that*-clause as complement and is able to constrain the form of the head (i.e. *that*), but – because of the Locality Principle – it cannot have access to the internal structure of the complements of *that*. That is to say, it cannot constrain the verb form: *leave* vs. *leaves*. Though, example (46b) shows that *demand* must actually have access to the VP headed by *leave* in order to licence (46a) constraining the verb form *leave*, and ruling out (46b), i.e. the verb form *leaves*.

To avoid the violation of the Locality Principle, Pollard and Sag (1994: 44–46) propose to treat the bracketed subordinate sentence in (46) as a VP (i.e. not as a CP) headed by the verb *leave* (cf. Figure 4.6). The complementiser *that* is thus analysed as a marker and not as a head, enabling *demand* to locally constrain *leave* and consequently avoiding the locality problem.[73] This analysis gets along with the semantic facts presented in the previous sections, treating markers as vacuous elements. In the following section, the analysis of markers as case-marking devices will be worked out in detail.

4.3.4.3 Marking case with markers

In order to analyse semantically vacuous prepositions as markers, some modifications to our system must be made:

- the feature geometry must be adjusted,
- a new principle must be proposed,
- a new ID-schema will be introduced, and
- another clause will be included in the SemP.

Firstly, the attribute MARKING (MARK) must be included in the feature geometry. MARK is an attribute of CAT as shown in AVM (47).

[73] See also Kiss (1995: 200–203) for a different solution assuming the complementiser to be the head in German. It is furthermore controversial whether complementisers add something to the meaning of sentences or not. While, for instance, temporal (e.g. *before*) or causal (e.g. *because*) complementisers are by no means vacuous, *whether* and *that* are more difficult to assess. Nevertheless, it has been assumed that "[...] the choice of complementizer determines the interpretation [of sentences]" (Haegeman and Ürögdi, 2010a: 240). For instance, *whether* and *that* seem to mark some kind of factivity in embedded sentences. For more details on that topic, see Truckenbrodt (2006) and Krifka (2014), a.o.

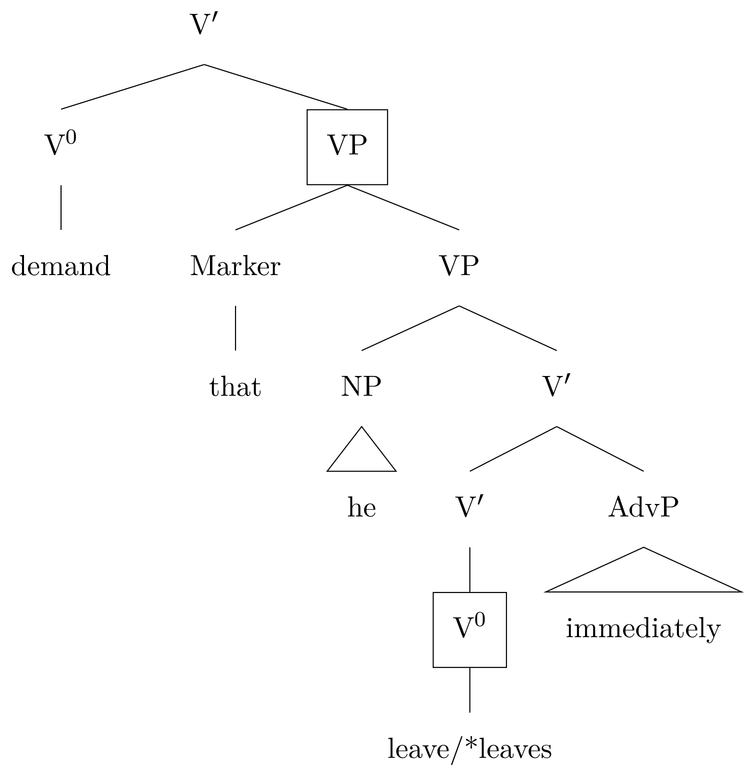

Figure 4.6: *that* as marker

(47)
$$\begin{bmatrix}
\textsc{phon} & \left\langle \textit{el doctor} \right\rangle \\
\textsc{synsem}|\textsc{loc} & \begin{bmatrix}
\textsc{cat} & \begin{bmatrix}
\textsc{head} & \begin{bmatrix} \textsc{case} & \textit{case} \\ \textit{noun} & \end{bmatrix} \\
\textsc{mark} & \textit{unmarked}
\end{bmatrix} \\
\textsc{cont} & \begin{bmatrix}
\textsc{ind} & \boxed{1} \begin{bmatrix} \textsc{per} & \textit{3} \\ \textsc{gend} & \textit{masc} \\ \textit{ref} & \end{bmatrix} \\
\textsc{rels} & \left\langle \begin{bmatrix} \textsc{inst} & \boxed{1} \\ \textit{def} & \end{bmatrix}, \begin{bmatrix} \textsc{inst} & \boxed{1} \\ \textit{doctor} & \end{bmatrix} \right\rangle \\
\textit{mrs} &
\end{bmatrix}
\end{bmatrix} \\
\textit{head-specifier-structure} &
\end{bmatrix}$$

Normally, lexical elements have the value *unmarked* by default, but some elements such as markers have the value *marked* (see also Footnote 74). While *unmarked* is a maximal type, i.e. it has no subtypes, *marked* can have different subtypes, depending on the kinds of markers a language uses. For instance, Spanish has markers of type *prepositional-form* (*p-form*), and – depending on the analysis (cf. Footnote 73) – also markers of type *complementiser-form* (*comp-form*), among others (cf. Figure 4.7).

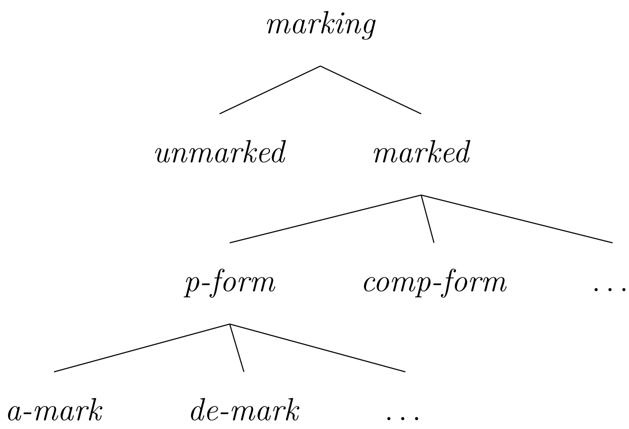

Figure 4.7: Type hierarchy for marking

In the AVM (48), the lexical entry of the marker *de* is given. As already mentioned, markers are semantically vacuous, i.e. they do not add any content to the phrase they are combined with. Therefore, they have only an empty list under CONT|REALS. Markers have information to add only under CAT, being treated as purely syntactic markers. The MARK value of *de* is *marked*, more precisely *de-mark*, a subtype of *marked*.

(48)
$$\begin{bmatrix} \textsc{phon} & \langle \textit{de} \rangle \\ \textsc{synsem}|\textsc{loc} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textsc{spec} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textsc{case} & \textit{gen} \\ \textit{noun} & \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{spr} & \langle\, \rangle \\ \textsc{comps} & \langle\, \rangle \end{bmatrix} \\ \textsc{mark} & \textit{unmarked} \end{bmatrix} \\ \textit{marker} & \end{bmatrix} \\ \textsc{mark} & \textit{de-mark} \end{bmatrix} \\ \textsc{cont}|\textsc{rels} & \langle\, \rangle \end{bmatrix} \end{bmatrix}$$

Markers select the phrases they mark through their SPEC feature, like determiners do with their nouns. In this case, the dummy preposition *de* is selecting an NP whose SPR and COMPS lists are saturated, thus no spurious ambiguities with respect to the hierarchical position of the complements of the noun arise. Furthermore, *de* selects only phrases which are unmarked avoiding double-marking in phrases, like **de de el doctor* ‘of of the doctor’.[74] The marker *de* additionally selects an NP whose case value is *gen*, which is a supertype of *lx_gen* and *str_gen*. This allows to use this one marker for both for lexical and structural genitive. Since nouns in Spanish are not inflected for case, the case value of NPs is underspecified (cf. (47)). By the combination of the marker *de* with the NP the result is a marked NP bearing genitive case. Marking the NP as *de-mark* and *gen* might seem dispensable because of a double marking, but NPs with the *a-mark* value and their non-overtly marked clitic counterparts show the necessity of the double specifica-

[74]Moreover, if clitics are analysed syntactically, and not by means of a lexical rule, they can be treated as lexical elements with the MARK value *marked* such that they do not get additional syntactic marking.

tion. While *a*-marked NPs are ambiguous with respect to accusative or dative, their non-overtly marked clitic counterparts (cf. Table 4.4) are distinguished only by their case values. That is, to make a distinction between accusative and dative both specifications for MARK and for CASE are required.

Now, in order to combine the marker and the NP, Pollard and Sag (1994: 45–46) propose a new principle – the Marking Principle (MARKP) (cf. (49)) – and a new Schema – the Head-Marker Schema (cf. (50) and (51)).

(49) Marking Principle (MARKP)
In a headed structure, the MARKING value coincides with that of the marker daughter if there is one, and with that of the head daughter otherwise.

The MARKP ensures that the MARK value of the phrase is structure-shared with the marker daughter, i.e. with the non-head daughter, in phrases of type *head-marker-structure*, but with the head daughter in other types of phrases.

(50) ID-schema 4: Head-Marker Schema
[A] phrase with DTRS value of sort *head-marker-structure* whose marker daughter is a marker whose SPEC value is structure-shared with the SYNSEM value of the head daughter, and whose MARKING value is structure-shared with that of the mother.

In addition, the Schema 4 – the Head-Marker Schema – defines the phrasal type for combinations of markers with phrases. It contains the information given by the MARKP, i.e. that the MARK value of the marker daughter is projected to the phrase (cf. $\boxed{2}$ in (51)), and it ensures that the SYNSEM value of the head daughter is unifiable with the SPEC value of the marker (cf. $\boxed{1}$ in (51)), which is ensured by the SPECP (cf. (50) in Section 3.3.2). Thus, the Head-Marker Schema contains the constraints postulated by the MARKP and the SPECP. The formalisation of the Head-Marker Schema in form of an implicational constraint is given in (51).

Further information of the daughters is projected to the phrase as has been assumed until now, that is, by virtue of the HFP and of the ValP. Yet, it is not clear how the semantic information must be projected. As mentioned in Footnote 71, it is not trivial to assume that markers have a "*pure logical* meaning" in contrast to the assumption of a "*vacuous* meaning" of markers (cf. Pollard and Sag, 1994: 45), this distinction matters. In the former case, the meaning of markers must be

(51) ID-schema 4: Head-Marker Schema

$$\textit{head-marker-structure} \rightarrow \begin{bmatrix} \textsc{synsem}|\textsc{loc}|\textsc{cat}|\textsc{mark}\ \boxed{2} \\ \textsc{hd-dtr}|\textsc{synsem}\ \boxed{1} \\ \textsc{nh-dtr}|\textsc{synsem}|\textsc{loc}|\textsc{cat} \begin{bmatrix} \textsc{head} \begin{bmatrix} \textsc{spec}\ \boxed{1} \\ \textit{marker} \end{bmatrix} \\ \textsc{mark}\ \boxed{2} \end{bmatrix} \end{bmatrix}$$

projected to the phrase, despite their "pure logical nature". In the latter case, we do not need to adopt a projection of the marker's meaning, since it is vacuous. That is to say, in order to capture a generalisation about the projection of meaning in elements of type *head-marker-structure*, it is necessary to adopt a position with respect to the elements which are to be counted as markers.[75] Since the Spanish markers *a* and *de* do not have a semantic contribution, I am assuming here that markers are vacuous.[76] Thus, a further extension of the SemP is needed to deal with the projection of content in a phrase of type *head-marker-structure*. In (52) and in its formulation as an implicational constraint in (53), the clause (52d) has been added ensuring that the CONT value of the head is projected to the phrase when it is of type *head-marker-structure*.

(52) Semantic Principle (SemP) (5th preliminary version)
For phrases of type *headed-structure*,

a. if the headed phrase is of type *head-argument-structure*:
    i. its CONT|IND value is structure-shared with the CONT|IND value of the head daughter and,
    ii. its CONT|RELS value is the concatenation of the RELS lists of the head daughter and the non-head daughter;

b. if the headed phrase is of type *head-adjunct-structure*:

[75] Based on word-order regularities and morphological behaviour, Van Eynde (2006) adopts a different position. He subsumes the combination of a head with (pre-nominal) adjuncts, specifiers, or markers under the type *head-functor-phrase*, that is, focusing stronger on the morphosyntactic similarities.

[76] That means that complementisers such as *before* or *because* should have another treatment, since they are not meaningless. Depending on the semantic analysis of complementisers such as *that* and *whether* (cf. Krifka, 2014), they could be treated either as markers, or as belonging to the same class as *before* and *because*.

   i. its CONT value is structure-shared with the CONT value of the non-head daughter.

c. if the headed phrase is of type *head-specifier-structure*:

   i. its CONT|IND value is structure-shared with the CONT|IND value of the head daughter and,

   ii. its CONT|RELS value is structure-shared with the CONT|RELS value of the non-head daughter.

d. if the headed phrase is of type *head-marker-structure*:

   i. its CONT value is structure-shared with the CONT value of the head daughter.

(53) Semantic Principle (SemP)

$$
\textit{headed-structure} \rightarrow
\begin{bmatrix}
\text{SYNSEM|LOC|CONT} \begin{bmatrix} \text{IND } \boxed{1} \\ \text{RELS } \boxed{2} \oplus \boxed{3} \end{bmatrix} \\
\text{HD-DTR|SYNSEM|LOC|CONT} \begin{bmatrix} \text{IND } \boxed{1} \\ \text{RELS } \boxed{2} \end{bmatrix} \\
\text{NH-DTR|SYNSEM|LOC|CONT} \begin{bmatrix} \text{RELS } \boxed{3} \end{bmatrix} \\
\textit{head-argument-structure}
\end{bmatrix}
$$

$$
\vee
\begin{bmatrix}
\text{SYNSEM|LOC|CONT } \boxed{1} \\
\text{NH-DTR|SYNSEM|LOC|CONT } \boxed{1} \\
\textit{head-adjunct-structure}
\end{bmatrix}
$$

$$
\vee
\begin{bmatrix}
\text{SYNSEM|LOC|CONT} \begin{bmatrix} \text{IND } \boxed{1} \\ \text{RELS } \boxed{2} \end{bmatrix} \\
\text{HD-DTR|SYNSEM|LOC|CONT} \begin{bmatrix} \text{IND } \boxed{1} \end{bmatrix} \\
\text{NH-DTR|SYNSEM|LOC|CONT} \begin{bmatrix} \text{RELS } \boxed{2} \end{bmatrix} \\
\textit{head-specifier-structure}
\end{bmatrix}
$$

$$
\vee
\begin{bmatrix}
\text{SYNSEM|LOC|CONT } \boxed{1} \\
\text{HD-DTR|SYNSEM|LOC|CONT } \boxed{1} \\
\textit{head-marker-structure}
\end{bmatrix}
$$

With this modifications made, the combination of phrases can be analysed correctly. As shown in Figure 4.8, the marker selects an NP whose VAL lists are empty,[77] bearing genitive case, and whose MARK value is *unmarked*. The NP *Luisa* fulfils these requirements. Since its case value is *case*, which is a supertype of *gen* (cf. Figure 4.1), both elements are unifiable (cf. Section 2.3). The MARK value of the marker daughter is projected to the phrase such that the resulting NP has the value *de-mark*. Next, the N^0_{ii} *tratamiento* combines with the marked NP_i *de Luisa*. The head selects a complement with structural case, and whose MARK value is *de-mark*. Since *gen* – the value of the NP_i – and *str* – the constraint posit by the N^0_{ii} – have a common subtype *str_gen*, the value of NP_i is therefore specified as *str_gen*.[78] Furthermore, with the combination of N^0_{ii} and NP_i not being of type *head-marker-structure*, but of type *head-complement-structure*, it is not the MARK value of the non-head daughter, but the one of the head daughter (i.e. *unmarked*) which is projected, the same occurring at the combination of N'_{ii} and DP.

In Kirchner (1999: 251–252), it was proposed to analyse the prepositional marking by means of a lexical rule which relates (under specific conditions[79]) the lexical entry of a noun bearing accusative with a noun bearing accusative and with the preposition *a* in its VAL list. That is to say, this lexical rule adds the preposition to the subcategorisation list of the noun. The rule proposed by Kirchner can apply only to nouns without complements, since his lexical rule takes a sign constrained to have a completely empty VAL list as input, and by virtue of being a lexical rule it cannot apply to phrases. In this account, Kirchner – following Allegranza (1998) – does not consider the specifier as a part of the VAL list, but as a functor. The problem with this lexical rule though is that it would account correctly for proper nouns which do not need a functor/determiner such as in (54b), but it would work neither for nouns with complements, nor for common nouns which need a determiner/functor, licensing in the latter case structures such as (54c), satisfying firstly the elements in the VAL list (i.e. the preposition), and then combining the result with the functor. What is more, Kirchner's rule would allow a phrase like (54d),

[77] The VAL feature has been left out in Figure 4.8 for the sake of clarity.

[78] This is compatible with the CaseP presented in (21) on page 134 in Section 4.2.

[79] The proposal of Kirchner (1999) refers to the accusative marking with *a* in Spanish. Since the *a*-marking in Spanish for accusative objects is related to some semantic aspects of the NP, Kirchner (1999: 252) constraints his lexical rule for NPs under specific conditions which he calls "humanity" and "identity".

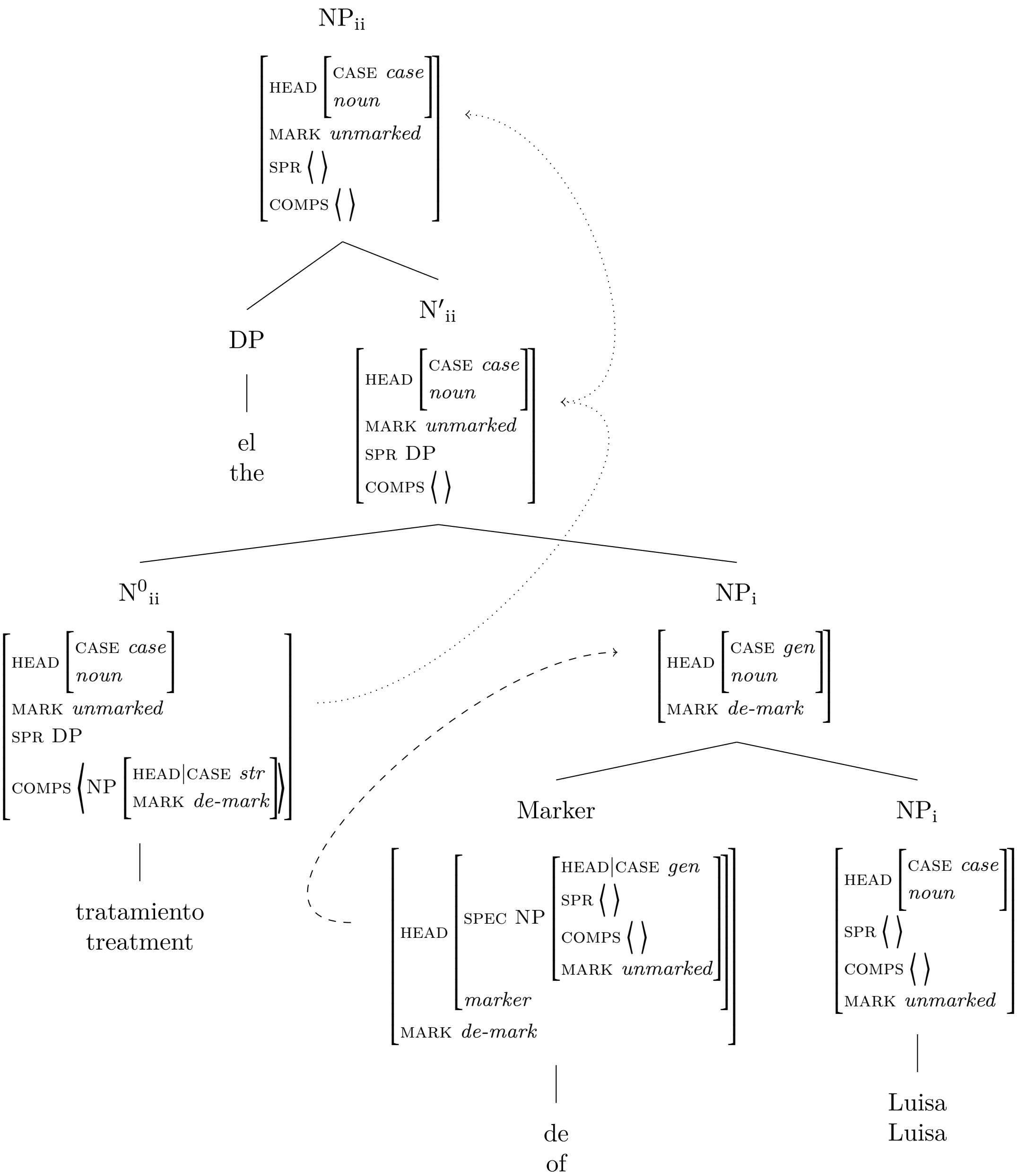

Figure 4.8: Syntactic case marking and projection of MARK value

since *el doctor* would be treated as an NP maximally specific with respect to the case value. The noun *tratamiento* would then be subcategorised for an NP bearing genitive, ignoring whether the NP is marked with the preposition or not. Moreover, by virtue of the Locality Principle, it would not be possible for the noun *tratamiento* to constrain that its complement, i.e. the noun in genitive, needs the preposition in its VAL list to be satisfied.

(54) a. el tratamiento *de-l* doctor
the treatment of-the doctor
'the treatment of the doctor'

b. el tratamiento *de* Luisa
the treatment of Luisa
'the treatment of Luisa'

c. * el tratamiento *el* *de* doctor
the treatment the of doctor

d. * el tratamiento *el* doctor
the treatment the doctor

e. * el tratamiento *de de el* doctor
the treatment of of the doctor

On the contrary, the account proposed here allows (54a)[80] and (54b) ruling out (54c), (54d), and (54e). (54c) is ruled out since the VAL lists of the noun must be emptied before the combination of the preposition with the noun is licensed.[81] Example (54d) is not licensed by this account, since *el doctor* – although it could be regarded as bearing genitive – does not have the value *de-marked* and the noun *tratamiento* is subcategorised for a marked NP. Example (54d) is ruled out, because a marker can only mark an unmarked NP.

To conclude, the analysis proposed here has shown how to deal with the syntactic case marking by virtue of the *head-marker-structure*. This analysis does not violate the Locality Principle, and gives an adequate treatment of what have been shown to be semantically vacuous prepositions. Furthermore, the generalisation offered by the CaseP can be expanded for Spanish and other languages which mark

[80] The contraction of the marker *de* with the determiner *el* is an issue to be solved by the function *f* in the PHON attribute, and which has nothing to do with the syntax or semantics of the structure, as it was pointed out at the beginning of Section 4.3.4.

[81] In Kirchner's analysis, it is not specified to which list (i.e. SPR, SUBJ, COMPS) the preposition should be added.

case via (dummy) prepositions. Thus, not only being applicable to languages with morphological case marking. In addition, this analysis is compatible with morphological case marking in the case of clitics, which do not need a preposition to be case-marked, but which bear lexically the value *marked*, i.e. inherently in the lexical entry.

4.4 Optional arguments

In this section, I will concentrate on a particular issue of complementation left open in Section 3.2.2, namely the optionality of arguments in NPs. The fact that some arguments in VPs – and almost all arguments in NPs – are optional has not received much attention. In the literature, the treatment of optionality is often reduced to the suggestion of a notational variant such as "the optional argument is written in brackets". A very detailed analysis of optionality is given by Jacobs (1994a). In his paper, he defines optionality and separates it from syntactic ellipsis; he distinguishes different kinds of optionality; and gives a lexicalist analysis of it (cf. Fodor and Fodor 1980 for a similar account based on meaning postulates avoiding lexical rules). Here, I am going to follow Jacobs (1994a) in many respects of his description of optionality, and I will unify his account with proposals for accounting for optionality made by Flickinger (2000) and De Kuthy and Meurers (2003).

In Section 3, the distinction between specifiers, arguments, and adjuncts was described. A necessary (but not sufficient!) diagnostic for adjuncts was that they can be omitted without yielding ungrammaticality. But, as was explained with example (15) in Section 3.2.1.1 repeated here as (55), not only adjuncts but also arguments can be omitted.

(55) a. [Mary] is painting [a landscape].
b. [Mary] is painting [a landscape] [for Peter].
c. [Mary] is painting.

The difference between optional arguments and adjuncts is that although an argument like *a landscape* in (55a) and (55b) can be dropped (cf. (55c)). However, the existence of the extension of *some* unspecified element fulfilling the function of the dropped argument (i.e. some painted object) is – despite the dropping – implied (cf. *something* in (56a)). Moreover, this syntactically non-realised object fulfils a theta-role in the predication of the head (cf. Flickinger, 1987: 69–70) and is understood as following the semantic restrictions provided by the predicate (cf. Katz and Postal, 1964: 83–84). Thus, *something* in (56a) is the theme of the *eating* event and must be something eatable. On the other hand, the existence of the extension of some element fulfilling the function of the non-realised adjunct is not implied. For instance, a person for whom something was painted[82] is in (55a) and (55c) not implied. Furthermore, the *somebody* for whom Anita ate in (56b) neither gets its theta-role from the predicate *to eat*, nor is semantically restricted in the same fashion as the dropped argument in (56a) was.[83]

(56) a. Anita ate. → Anita ate *something.*
 b. Anita ate. ↛ Anita ate *for somebody.*

But not *every* argument is optional, some heads have the possibility to drop arguments (cf. (57a) vs. (57b)), while others do not (cf. (57c) vs. (57d)). This is the case in Jacobs's examples such as (57) (adapted from his examples (1) and (2)).

(57) a. dass er morgen *jemanden* heiratet
 that he tomorrow somebody marries
 'that he marries somebody tomorrow'

 b. dass er morgen heiratet
 that he tomorrow marries
 'that he gets married tomorrow'

 c. dass er versehentlich *jemanden* aufweckt
 that he accidentally somebody wakes.up
 'that he accidentally wakes somebody up'

 d. * dass er versehentlich aufweckt
 that he accidentally wakes.up
 'that he accidentally wakes somebody up' [intended reading]

For instance, *heiraten* 'marry' has an optional argument, and not realising this optional argument implies however its existence (cf. (57a) vs. (57b)), since it is

[82] Jacobs (2003: 386–387) takes a different view. He proposes for *some* transitive verbs a polysemy. One lexical entry would have the benefactor dative as an argument, and the other would not. This is due to the fact that benefactors cannot be iterated, cf. Section 3.2.1.4.

[83] That is the reason why in some analyses (cf. Bresnan 1978: 15–20), the dropped argument is existentially bound. For two alternative analyses which also include an existential quantifier but at a different level of representation, see the criticisms in Fodor and Fodor (1980) and Mittwoch (1982).

not possible "to marry alone". On the contrary, it is impossible for the German verb *aufwecken* 'wake up' to drop its argument without yielding ungrammaticality, not only because the implication does not hold, but because the phrase becomes ungrammatical (cf. (57c) vs. (57d)).[84]

These two cases show the distinction between adjuncts and optional arguments (cf. (55)), and between optional and obligatory arguments (cf. (57)). This distinction matters in order to delimit the cases we are going to discuss in this section. In Section 4.4.1, I will present different cases of optionality which have been discussed in the literature. In Section 4.4.2 different analysis of optionality will be presented and discussed, and in Section 4.4.3 and I will offer an extension of them.

4.4.1 Forms of optionality

Extracting the essence of Jacobs' idea of optionality, three main assumptions – given in (58) – must be taken into consideration when speaking about optional arguments (cf. too Fodor and Fodor 1980 and Eisenberg 2013: 60–63).

(58) Optionality:
Y is an *optional argument* of a head X, iff

1. Y is an argument of X,
2. X has the same intension[85] in a combination with Y as without Y,
3. the existence of an element Y is – despite its non-realisation – implied when X is uttered, and
4. the head X can be used (under certain circumstances) in an utterance without Y.

The second clause in the list above (cf. 2) makes a distinction in the analysis for the non-realised arguments of a head like *heiraten* 'to marry' (cf. examples (57a) and (57b)) on the one hand, and the analysis for the arguments of a head like *hängen*

[84] In German, the verb *aufwecken* 'to wake up' does not show the causative-inchoative alternation as the English counterpart, meaning 'I woke up' in the intransitive version and 'I woke somebody up' in the transitive one.

[85] The distinction between *intension* and *extension* is relevant here, since the extension of a verb with its argument is different from its extension without the argument. Thus, neither the term *extension* nor the less specific term *meaning* would really do the job. Keeping this in mind, in the following, I will use the term *meaning* in cases in which the ambiguity can be neglected. See for instance Zimmermann and Sternefeld (2013: 170–204) for further details of the distinction.

'to hang' (cf. (59a) and (59b)) on the other hand, since *heiraten* has the same meaning in both cases, i.e. with and without argument, while *hängen* does not. The transitive version of *hängen* is interpreted causative (cf. (59a)), and the intransitive one as a state (cf. (59b)). Thus, *hängen* has two different interpretations according to the valence of the verb which is similar to the case of *wake up* in English (cf. Footnote 84).

(59) a. Er *hängt* [das Bild].
he hangs the picture
'He is hanging the picture up.'

b. Er *hängt*.
he hangs
'He is hanging something up.' [unavailable reading]
'He is hanging.' [available reading]

Furthermore, both forms of *hängen* show differences with respect to their inflectional paradigms. The transitive (causative) verb belongs to the weak declension class, building its simple past forms with the stem *hängt-* and its participle perfect passive form is *gehängt*. On the contrary, the intransitive (state) version belongs to the strong declension class and uses *hing-* as simple past stem and *gehangen* as participle perfect passive.[86] Such differences in the inflectional paradigms are interpreted as a signal for (partial) homonymy or at least for polysemy (cf. Wechsler, 2015: 10). This fact suggests a lexical distinction between both forms of *hängen*, and since a systematic pattern can be found with respect to causative, inchoative, and state interpretations of verbs (cf. for instance Bierwisch 2011 and Wechsler 2015: 60–94) both lexical entries should then be related to each other by means of a lexical rule.This distinction is in some cases clearer than in others. For instance, in the examples (60a) vs. (60b) and (60c) vs. (60d), adapted from Eisenberg (2013: 61–62) (his (13a) and (13b)), it is more perspicuous that we are dealing with different lexical entries.

(60) a. Die Schule *brennt* [auf Revanche].
the school burns for revenge
'The school really wants revenge.' [obtained reading]

[86] In some German varieties, the two forms of *hängen* are distinguished further by their selection of auxiliaries for perfect tense, the transitive form selecting *haben* 'to have', and the intransitive one *sein* 'to be'.

b. Die Schule *brennt*.
the school burns
'The school is (literally) on fire.' [obtained reading]

c. Julia *entbindet* [Marco Polo] [von seinem Versprechen].
Julia disengages Marco Polo from his promise
'Julia releases Marco Polo from his promise.' [obtained reading]

d. Julia *entbindet*.
Julia disengages
'Julia gives birth to a child.' [obtained reading]

In these cases, it is to some extent possible to imagine the relation between the transitive and the intransitive version of the examples, which however bear clearly different meanings. But, there is no *systematic* way to connect their meanings by means of valence reduction in comparison to the examples in (59). That is to say, we are dealing here with a continuum from clearly distinct lexical entries (cf. (60)) with different valences, through distinct lexical items, which are related by lexical rules (cf. (59)), to the same lexical entry which by virtue of optional arguments differ in their realised valences (cf. (57a) and (57b)).[87]

The third clause of the list given above (cf. 3) states that, although the optional argument is not realised, it is nevertheless implied by the semantics of the head (cf. Bierwisch, 2009: 291–292). The syntactically non-realised but semantically implied object has been sometimes analysed as an unspecified pronoun similar to *something* deleted by means of a transformation (cf. Chomsky 1964: 37–44; Katz and Postal 1964: 80–84), but semantically existent and existentially bound (cf. Bresnan, 1978: 15–20).[88] The third clause points out the distinction between the lexical entry of verbs like *heiraten* 'to marry' (cf. (57a) and (57b)) and verbs like *treten* 'to kick' (cf. (61a) and (61b)). The verb *treten* does not need to have an implied object in comparison to *heiraten* (cf. (61b) in the second reading). It is possible for this verb to be used as describing a "specific kind of body movement" without necessarily implying an object which gets kicked (cf. Fodor and Fodor 1980: 763;

[87]In Section 4.4.2, the terms *lexical entry* and *lexical item* will be explained in more detail. For now, a lexical entry is the underlying form stored in the lexicon which can yield to distinct lexical items. In his paper, (Jacobs, 1994a) does not make a distinction and uses the term *lexical entry*.

[88]See also Mittwoch (1982) for arguments *against* the interpretation of the non-realised argument as an instance of a deleted *something*-pronoun. Her criticism is based mostly on the different interpretations the verbal events can have according to the presence/absence of the argument.

Pollard and Sag 1987: 132–133 and Müller 1999: 34–35). Müller (1999: 35) gives karate lessons as a possible context, in which one does not need to kick someone but it is all about the movement, that is the second reading of (61b). On the other hand, the first reading of (61b), is completely parallel to *heiraten* implying the existence of a kicked object. That is to say, the difference between the first and the second reading of (61b) is that the former has an optional argument which has not been realised, while the latter does not have this dropped argument *at all*.

(61) a. Sie *tritt* [ihren Bruder].
she kicks her brother
'He kicks her brother.'

b. Sie *tritt*.
she kicks
'She kicks someone.' [obtained reading]
'She stretches her leg fast.' [obtained reading]

Therefore, the semantics of the transitive and intransitive *treten* are actually different, since they differ in the cardinality of their semantic arguments. This leads again to two different lexical items – one transitive with optional argument, and one intransitive without semantically implied object – which must be related by means of a lexical rule.[89] The same kind of ambiguity is found in so-called *habitual* readings (cf. Gerstner-Link and Krifka, 1993: 974–975),[90] which in contrast to the case of *treten* are interpreted as a general property fulfilled by the subject, as the example (62b) adapted from Eisenberg (2013: 62) shows.

(62) a. Monika *schreibt* [eine Dissertation].
Monika writes a dissertation
'Monika writes a dissertation.'

[89] It is actually not quite easy to relate both kinds of *treten* by means of a lexical rule with the feature geometry adopted until now. Elementary predications as they have been assumed here are predicates with a fixed cardinality of arguments (or theta-roles). The lexical rule to be adopted would have to relate an elementary predication *treten′* with an argument cardinality n to an elementary predication *treten″* with an argument cardinality n−1. Another possibility would be to assume a Neo-Davidsonian approach (cf. Parsons, 1990) such that the single semantic arguments would be accessible and deletable without affecting the elementary predication.

[90] These readings have also been called *generic*, since they are analysed by means of the genericity operator binding an event/situation variable provided by the predicate (cf. Krifka, 1995b). They are also called *dispositional*, since they show an inherent property of the subject (cf. Alexiadou and Schäfer, 2010). See also Ágel (2000: 253).

b. Monika *schreibt*.
Monika writes
'Monika is a writer.' [obtained reading]

The habitual reading in (62b)[91] does not need an implied object, namely what it is that is written, since the predicate is assigning to the subject the "property to write habitually". In (62), we are actually facing the same problem as in (61). We are dealing with two lexical items, related by a lexical rule, the difference between the second reading of (61b) and the reading obtained in (62b) concerns the lexical rule to be applied. In the former case the event variable of the predicate must be bound existentially, while in the latter case a generic operator must be used to bind the variable.

The fourth clause for the definition of an optional argument (cf. 4) states – trivially – that an optional argument can be left unrealised, but it states further – non-trivially – that this dropping can occur *under certain circumstances*. This point summarises Jacobs's distinction between ellipsis and optional arguments. While Jacobs (1994a: 305) sees *ellipsis* as a syntactic procedure not to realise phonetically a constituent, *optionality* is a feature of an argument of a lexical entity. He elaborates three main aspects of ellipsis which distinguish them from optional arguments (cf. Jacobs, 1994a: 305):

- The omission of a constituent X is not dependent on the valence-bearer.
- The omission of a constituent X is dependent on the syntactic construction.
- If X is omitted, it is present in the syntactic construction as a phonetically empty element.

So, for instance, *obligatory* arguments such as the object of *aufwecken* 'to wake up' (cf. (57d)) can be dropped in certain syntactic constructions such as the so-called *topic-drop* in German (cf. Fries, 1988b) as example (63) adapted from Jacobs (1994a: 305) shows.[92]

[91] Take into account, that example (62b) does not only have the "habitual reading" but also the reading with omitted optional argument, similar to *treten* 'to kick' in (61b).

[92] The grammaticality judgement of (63b) is mine. I have checked it with other native speakers and they agree with it. Jacobs (1994a: 305) proposes a "?".

(63) a. Ich hab' den schon *aufgeweckt*.
I have him already woken.up
'I have woken him up already.'

b. * Ich hab' schon *aufgeweckt*.
I have already woken.up
'I have woken him up already.' [intended reading]

c. $\varnothing_i$ Hab' ich schon t_i *aufgeweckt*.
have I already woken.up
'I have woken him up already.'

The examples show that the sentence is grammatical with the object overtly realised (cf. (63a)) and ungrammatical if it is not realised (cf. (63b)), but in a specific syntactic structure, i.e. with the topical, phonetically empty pronoun in the prefield,[93] the sentence turns out to be grammatical. This kind of syntactic ellipsis is, according to Jacobs, not to be considered as optionality, since it is not licensed by the valence specifications of the lexical entry, but by a syntactic construction. In his paper, Jacobs (1994a) distinguishes different circumstances under which optional arguments can be omitted. I am going to illustrate them with example (64) (adapted from his (21)–(23)).

(64) a. dass er morgen (jemanden) *heiratet*
that he tomorrow somebody marries
'that he marries somebody tomorrow'

b. dass er (in die Scheidung) *einwilligt*
that he in the divorce agrees
'that he agrees to divorce'

c. dass er (uns die Karten) *gibt*
that he us the cards gives
'that he deals the cards to us'

d. dass er (den Vorschlag) *akzeptiert*
that he the proposal accepts
'that he accepts the proposal'

[93] As Jacobs (1994a: 305) points out, it is not possible to interpret (63c) as a verb-first declarative sentence, furthermore, the topical constituent is often related with the sentence intial position. See Krifka (2007) for the notion of *topic*, and Fries (1988b) and Schalowski (2009) for more details on the characteristics of topic-drop in German.

The four verbs *heiraten* 'to marry', *einwilligen* 'to agree', *geben* 'to give', and *akzeptieren* 'to accept' are – according to Jacobs (1994a: 299) – different with respect to the conditions under which they can drop their arguments. He highlights the distinction by means of two features:[94] *definiteness* and *specification*. In order to avoid the terminological confusion with the familiar semantic termini *definiteness* and *specificity*, I will rather use: *established* (*est*) and *particularised* (*pcl*) and introduce them into our feature geometry as values of an attribute which marks the kind of optionality (cf. Section 4.4.3). Firstly, in (65), I am giving a definition of the notion *established* extracting the facts given as necessary for this feature to hold (cf. Fodor and Fodor 1980: 767–769 and Jacobs 1994a: 299–301).

(65) ESTABLISHED:
An argument *X* is said to be *established* iff its discourse referent has already been introduced in the discourse, otherwise it counts as *not-established*.[95]

Now with respect to example (64), while (64a) and (64c) do not need their objects to be established in order to be omitted, the omission of the object in (64b) and (64d) is only licensed when the object is established. This is illustrated by the following examples in (66) (Jacobs, 1994a: 299–300).[96]

(66) a. Maria *heiratet* morgen, aber ich weiß nicht wen.
Maria marries tomorrow but I know not who
'Tomorrow, Maria is getting married, but I do not know with whom.'

b. # Maria *willigt* morgen *ein*, aber ich weiß nicht in was.
Maria agrees tomorrow PRT but I know not in what
'Tomorrow, Maria is going to agree to something, but I do not know to what.' [intended reading]

[94] Jacobs (1994a) does not work with inheritance hierarchies, so the ontological status of his features is not quite clear in this case. Nevertheless, they are helpful to outline the distinctions, and I will translate them into the HPSG system as types.

[95] Here, the similarity between *established* and *definite* becomes clear, but since the property "to be already introduced in the discourse" is only one of several properties that are related to *definiteness* (see also familiarity, uniqueness, identifiability, etc.), I am keeping both notions apart (cf. Heim 1988: 298–302 for the term *familiarity*; Russell 1905: 481–483 for the term *uniqueness*; and Vater 1984: 32–38; Heim (2011); and Lyons 1999: 253–281 for general overviews).

[96] The abbreviation PRT in example (66b) stays for *particle*, i.e. the part of the verb *einwilligen* which can be morphosyntactically separated.

That is to say, the optional argument of the verb *einwilligen* must be established, but this does not mean in turn that the optional argument of the verb *heiraten* has to be non-established. As the following examples (67)–(69) taken from Jacobs (1994a: 298) show, the optional argument *can* but does *not need to* be established, and if it is established, then it is preferred to interpret the dropped argument referring to the given antecedent.

(67) Ich weiß nicht, warum heutezutage noch irgendwer *heiratet*.
I know not why nowadays still anybody marries
'I do not know why nowadays people are still getting married.'

(68) Peter ist schon lange mit Gerda verlobt, aber *heiraten* will er erst, wenn Gerda Professorin ist.
Peter is already long with Gerda engaged but marry want he first when Gerda professor is
'Peter has been engaged with Gerda for a long time, ...

a. ... but he does not want to marry *somebody* until Gerda gets her professorship.' [non-preferred reading]

b. ... but he does not want to marry *her* until she gets her professorship.' [preferred reading]

(69) Peter ist schon lange mit Gerda verlobt, aber jemanden *heiraten* will er erst, wenn Gerda Professorin ist.
Peter is already long with Gerda engaged but somebody marry want he first when Gerda professor is
'Peter has been engaged with Gerda for a long time, ...

a. ... but he does not want to marry *somebody* until Gerda gets her professorship.' [preferred reading]

b. ... but he does not want to marry *her* until she gets her professorship.' [non-preferred reading]

Example (67) shows that the omitted object of *heiraten* can be interpreted as *somebody* if it has not been introduced in the previous discourse. On the other hand, in examples (68) and (69) a possible discourse referent for the object of *heiraten*, namely *Gerda*, has been introduced. In example (68), it is preferred to interpret the omitted argument as the established antecedent (cf. (68b)). The interpretation of the omitted argument as *somebody (else)* is clearly disfavoured (cf. (68a)), while not impossible (Peter would have to be very mean in this case).

In example (69), the argument has not been omitted but expressed as *somebody.* The preferred interpretation is in this case (69a), that is, interpreting *somebody* as not being coreferent with Gerda. However, the interpretation given in (69b) is accessible, though odd to some extent.[97] In this case, I differ from Jacobs's judgements. While he rates the disfavoured interpretations (68a) and (69b) as not possible (cf. Jacobs, 1994a: 298–299), I just rate them as disfavoured. Moreover, it is possible to rank their (dis-/)preferences as given in Table 4.5.

(68b)	>	(68a)/(69a)	>	(69b)
most preferable				least preferable

Table 4.5: Preferences due to (almost) pragmatic criteria

This preferences can be explained due to pragmatic criteria assumed for independent reasons. Firstly, as pointed out in Chomsky (1964: 41), omitted elements must be recoverable. In (68), the omitted element can be recoverable in two ways, it is either recoverable from the context (being coreferent with Gerda, i.e. (68b)), or it is maximally unspecific, i.e. (being interpreted as *something* (68a)). At this point no preference has been established, but this syntactic condition for deletion rules out to interpret the non-realised argument as a *specific* element which has not been introduced by the context, for instance Maria. Now, as is known from topic-drop and other cases of ellipsis, given or topical elements have sometimes the tendency to be omitted (cf. Krifka, 2007: 37–38). This would explain the tendency to favour in example (68) the interpretation (68b) over (68a). Furthermore, introduced discourse referents are normally referred to by *definite* pronouns (e.g. *she*), and not by *indefinite* ones (e.g. *somebody*). This clarifies the preference of (69a) over (69b). In addition, a pragmatic principle given in Krifka (1989a: 72 & 224) and Krifka (1989b: 86) – based on Grice's maxims of quantity, quality, and relevance – helps to explain the preference scala given above.

(70) Pragmatic Principle (Krifka, 1989b: 86)
If two expressions α, β are (i) both applicable, (ii) α is more specific than β, (iii) α is not more complex than β then choose α.

[97] Take into account that the expression *to marry somebody* semantically does not rule out that this somebody could be Gerda. Due to different reasons, which will be explain below, the use of *somebody* instead of dropping the argument, or using a definite pronoun, is rather interpreted as "somebody else".

Comparing firstly (68b) and (69b) – since both yield the same interpretation, i.e. interpreting Gerda as the object of the predicate – the expression with the omitted object is more specific since it can be easier used for the definite interpretation, and it is less complex since it is phonetically empty. Thus, clearly (68b) must be favoured over (69b). Turning now to (68a) and (69a), both with the "somebody"-interpretation, the overt realisation of *somebody* is more specific than the omitted argument, but the omitted argument is less complex than the overt realised *somebody*. Thus, both seem to reflect their shared middle position in the scale. Hence, taking all parameters together, we arrive at the preference scale just offered.

Jacobs (1994a: 298) analyses the distinction between the optionality of *heiraten* and *einwilligen* as a distinction of the semantic variables which both predicates take (cf. (71a) and (71b)). He distinguishes two kinds of free variables, namely *neutrally established* (u, v) and *established* variables (x, y, z). Neutrally established variables are free variables which saturate an argument position of the predicate and which neither demand nor forbid the overtly givenness[98] of the (denotation of the) referent of the argument (cf. (67)–(69) and u in the semantic representation (71a)). In contrast, when established variables are free, they require a discourse referent which has already been introduced (cf. Jacobs, 1994a: 298–301), see for instance (66b) and x in the semantic representation (71b).[99]

(71) a. λy [heiraten$(u)(y)$]
b. λy [einwilligen$(x)(y)$]

Now, the second notion introduced by Jacobs (1994a: 301–304), called here *particularised*, will be defined as follows.

(72) PARTICULARISED:
An argument X is said to be *particularised* iff the extensional set of possible referents for X is strongly restricted in comparison to the extensional set of possible referents for X when the argument is not omitted, otherwise it counts as *not-particularised.*

[98] I am writing *overtly givenness*, since strictly speaking *givenness* does not imply that the given expression has been *overtly* introduced in the discourse, moreover it only implies that the *denotation* of the expression is in the present common ground (cf. Krifka, 2007: 37).

[99] For the sake of clarity, I am following Jacobs (1994a) and omitting here the situation/event variable which he uses in Jacobs (2003). Compare also the solution offered in Fodor and Fodor (1980: 767–769). They make the distinction between established and non-established variables through variables bound by a ι-operator or by an existential quantifier, respectively.

It is a known fact that predicates not only state syntactic restrictions to their arguments but also semantic ones, sometimes called *selectional rules* (cf. Chomsky, 1965: 148–160).[100] For instance, example (73) is not odd because of syntactic, but because of semantic reasons.

(73) # Constantin is drinking {the paper / the library / the tombstone}.

The concept of *particularised* has to do with these semantic restrictions, namely when the semantic restrictions are intensified. The definition given in (72) can be explained by means of example (64c). The optional arguments of the verb *geben* can only be omitted in a very specific giving-situation. That is, it must be a situation in which the participants are card players and the given objects are playing cards. Thus, *geben* with omitted optional arguments must be considered as a strongly restricted subset of events of *geben* without omitted arguments. Jacobs (1994a: 301) specifies that the *geben* version with optional arguments must be semantically restricted by a meaning postulate such as (74).[101]

(74) $\forall x \forall y \forall z$ [geben$'(x)(y)(z) \rightarrow$ geben$(x)(y)(z) \wedge$ cardplayer$(y) \wedge$ cardplayer$(z) \wedge$ card(x)]

This meaning postulate states that a predicate is a *geben′* predicate if there is a *geben* predicate of which x, y, and z are arguments; and its y and z arguments are instances of card players; and the x argument is an instance of playing cards. That is to say, the set of events of *geben′* is strongly restricted, but not because the *intension* of the predicate is different, but only because the extensional set denoted by the *arguments* is semantically stronger restricted in the optional variant than in the not-optional one; that is the arguments must be particularised (cf. assumptions for optionality in (58)). A welcome effect of this analysis is that *geben′* and *geben* are to some extent related, and a completely idiosyncratic analysis of *geben′* is not necessary (cf. the analysis of *geben* offered in (89). Furthermore, as in the case of *heiraten*, the variables of the optional arguments (u and v) are underspecified

[100] Selectional rules are also called *s-selectional features*, in contrast to *c-selectional features*, which constrain the categorial aspects selected by the head. See Adger (2004: 87) and Bierwisch (2006: 93–94).

[101] Jacobs (1994a: 301) proposes three meaning postulates which must apply for the verb *geben* to be able not to realise its arguments. In (74), I have merged these three postulates into a single one.

with respect to their established value (neutrally definite in Jacobs' terminology), i.e. they can but do not need to have been introduced in the discourse (cf. (75)).

(75) λz [geben$'(v)(u)(z)$]

The last example with *akzeptieren* 'to accept' (cf. (64d)) differs from the other three in that the omitted optional argument must be established as well as particularised. In example (76a), the object is kept vague and not omitted, in example (76b) this very object has been omitted yielding an ungrammatical/semantically marked sentence, since it is necessary for it to have been established in the discourse, being thus ruled out with the following expression: *but I do not know what*.

(76) a. Er hat etwas *akzeptiert*, aber ich weiß nicht was.
he has something accepted but I know not what
'He has accepted something, but I do not know what.'

b. # Er hat *akzeptiert*, aber ich weiß nicht was.
he has accepted but I know not what
'He has accepted something, but I do not know what.'
[intended reading]

Moreover, *akzeptieren* 'to accept' demands that the omitted argument is particularised, as the examples (77) and (78) show. Firstly, example (77) gives a context in which two participants have to agree on *a plan*, and Horst has to accept this plan. In contrast, example (78) gives a context in which Horst has to accept *a person*. As (77a) shows, it is possible to omit the argument if it is some kind of proposal, but the contrast between (78a) and (78b) show that it is not possible to omit an argument which denotes a person (cf. Jacobs, 1994a: 302).

(77) Horst and Marianne have been working out *a master plan* to take over world supremacy, many details were intensively discussed and now they need to reach an agreement. After some hours, Marianne comes out of the room and says:

a. Horst hat (den Vorschlag) endlich *akzeptiert*.
Horst has the proposal finally accepted
'Horst has finally accepted (the proposal).'

(78) Horst has *a sister*, who he has just met for the very first time. His mother tries that both sympathise with each other, but little Horst is stubborn. After some hours, his mother comes out of the room and says:

a. Horst hat sie endlich *akzeptiert*.
Horst has her finally accepted
'Horst has finally accepted her.'

b. # Horst hat endlich *akzeptiert*.
Horst has finally accepted
'Horst has finally accepted her.' [intended reading]

Summing up, according to the classification of Jacobs (1994a), optionality is defined as given in (58), and the different sorts of optionality are described by means of the notions *established* and *particularised*. In Table 4.6 the results of the discussion are presented. Following Jacobs' definition of optionality cases like *treten* 'to kick' in (61b) and *schreiben* 'to write' in (62b) are not considered as verbs with optional arguments, but as different verbs. This distinction is made by means of the second clause of (58),[102] which requires the omitted argument to be nevertheless implied. As I have pointed out (cf. for instance, Footnote 89), it is not necessary to posit a homonymy here, since e.g. *treten* with and without elements are closely related to each other. What is necessary in such cases are for instance lexical rules which eliminate an argument from the elementary predication of the verb, or another semantic mechanism to model elementary predications. That is to say, the non-realisation of the arguments of *treten* or *schreiben* would not be based on optionality but on regularities at another level of description (e.g. lexical rules, implicational constraints, semantic modelling, etc.).

VERB	EST	PCL	IMPL. ARG.	OPT
heiraten	−	−	+	+
einwilligen	+	−	+	+
geben	−	+	+	+
akzeptieren	+	+	+	+
treten	−	−	−	−

Table 4.6: Categorisation of optionality according to Jacobs (1994a)

In the following section, different analyses of optionality from the literature will be presented and an HPSG approach will be proposed which incorporates all the facts, that have been discussed in the current section.

[102]For this position see Pollard and Sag (1987: 132–134) and Jacobs (1994a); cf. also (Eisenberg, 2013: 60–63) for counterarguments.

4.4.2 Former analyses of optionality

Heads with optional arguments have been analysed in different forms. In the list below, I am presenting five different ways which have been proposed to account for optionality. Optionality is accounted for by means of

1. a *transformation* which deletes the non-realised object (cf. Chomsky 1964: 37–44; Katz and Postal 1964: 80–84).
2. *a syntactically present but phonetically empty pronoun* (cf. Grewendorf, 1995: 1312–1313).
3. *disjunct valence lists* in one lexical entry (cf. Bresnan 1978: 15–20; Pollard and Sag 1987: 132–134; Flickinger 1987: 69–70; Jacobs 1994a; Müller 1999: 34–35; Eisenberg 2013: 60–63).
4. *distinct lexical entries* (cf. Fodor and Fodor 1980; Jacobs 1994a; Eisenberg 2013: 60–63).
5. distinctions in the *feature geometry* and by *syntactic constraints* in the *type hierarchy* (cf. Flickinger 2000; De Kuthy and Meurers 2003).

It is not the case that only one of these proposals can be used. In fact, depending on the underlying definition of optionality – i.e. depending on which phenomena are to be counted as instances of optional arguments – on the different classes of optionality assumed, and on the explanatory devices of the framework used, more than one of these proposals can or must be chosen to account for the wide range of data.

The analyses in 1,[103] 2 and 5 are more restricted to be implemented in a different framework, since they depend on theory-internal assumptions. For instance, 2 is more likely to be used in a framework like MGG, which makes broad use of empty

[103] I am not going into the details of Chomsky's and Katz and Postal's analyses since, firstly, they are based on a transformational approach which is not commonly used any more; secondly, their mechanisms of deletion are very complex, and the amount of complexity is by no means related to the amount of grammatical processing as was pointed out by Bresnan (1978: 14–16). Nevertheless, I am also going to propose a deletion mechanism, however, in a simpler way due to its lexical licensing by virtue of type hierarchies.

categories for explanatory purposes.[104] A framework like HPSG, which tries to keep the grammatical description as much surface-oriented as possible, avoids the use of empty categories, as long as they are not indispensable. A solution like 5, on the contrary, is only available in a constraint-based framework which is modelled by means of an inheritance hierarchy.

In his analysis of optionality with empty elements (cf. 2 on the list above), Grewendorf (1995: 1311–1313) subsumes not only the cases of optionality covered by the definition given above (cf. (58)), but also the cases of topic-drop mentioned before, which are considered here – following Jacobs (1994a: 304–306) – as a kind of argument omission licensed by specific syntactic and information-structural configurations. The second way to account for optionality is the one pursued by and Jacobs (1994a: 296), and which has also been used in HPSG formalisations. For instance, Pollard and Sag (1987: 132–134) formalise optionality by means of disjunct valence lists in a lexical entry (cf. example (79)[105] which has been adapted to our feature geometry).

That is to say, a verb such as *heiratet* '(she) marries' would have a lexical entry with a valence list specifying the subject argument, and additionally either a COMPS list with the specification for a complement, or an empty COMPS list. This disjunctive specification of the valence list in one single *lexical entry* yields two *lexical items* with distinct valences.[106] Depending on which lexical item is being described, the first AVM will unify with the second or the third AVM. The terms *lexical entry* and *lexical item* are often not distinguished in the literature,[107] the former being normally used for both concepts (cf. Jacobs 1994a; Flickinger 2000;

[104] I cannot go into the discussion about empty categories. See Featherston (2001: 8–38) and Müller (2016a: 549–568) for a comparison of the use of empty categories in HPSG and in MGG approaches.

[105] For the sake of clarity in AVMs with disjunctions, I am writing the begin of disjunction's domain with a period. Thus, an AVM such as: A ∧. B ∨ C means (A ∧ B) ∨ (A ∧ C), avoiding more brackets in the structures.

[106] See also the distinction between Bresnan's and Fodor and Fodor's analyses. While Bresnan (1978) argues for an analysis with disjunctive valences with a distinct semantic/functional structure for each valence list, Fodor and Fodor (1980) offer an analysis with distinct lexical entries which are related by means of meaning postulates and general rules of logic.

[107] Sometimes, they are not distinguished in the literature, because they are not distinguished in the framework either. This is often the case in frameworks which use the lexicon as a place for idiosyncrasies and irregularites. See Büring and Hartmann (1991) for a discussion on this topic.

(79)
$$
\begin{bmatrix}
\text{PHON} & \langle \textit{heiratet} \rangle \\
\text{SYNSEM}\mid\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1}\ \text{NP}[\textit{str}]_{\boxed{4}}\ ,\ \boxed{2}\ \text{NP}[\textit{str}]_{\boxed{5}} \right\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{3}\ \textit{event} \\ \text{RELS} & \left\langle \begin{bmatrix} \text{EVENT} & \boxed{3} \\ \text{AG} & \boxed{4} \\ \text{TH} & \boxed{5} \\ \textit{marry} & \end{bmatrix} \right\rangle \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\
\textit{stem} &
\end{bmatrix}
$$

$$
\wedge.
$$

$$
\begin{bmatrix} \text{SYNSEM}\mid\text{LOC}\mid\text{CAT}\mid\text{VAL}\mid\text{COMPS} & \boxed{2} \end{bmatrix}
$$

$$
\vee
$$

$$
\begin{bmatrix} \text{SYNSEM}\mid\text{LOC}\mid\text{CAT}\mid\text{VAL}\mid\text{COMPS} & \langle\ \rangle \end{bmatrix}
$$

a.o.).[108] I am using the distinction taking a lexical entry as an underlying form in the lexicon which by means of lexical rules, disjunctive constraints, or further mechanisms can yield distinct lexical items. For example, instances of *homonymy* would have to be described by means of distinct lexical entries, since the relation between the resulting lexical items is – at least synchronically speaking – not transparent. Instances of *polysemy*, on the other hand, should be described in one single lexical entry which by means of further constraints yield distinct lexical items, with the relation between the resulting lexical items being traced back to the common lexical entry. The distinction – although often ignored in the literature – is not trivial at all. Two distinct lexical entries are unrelated elements in the lexicon, while two distinct lexical items *can* be related elements with one single core.

With this kind of formalisation, it is possible to subsume a further case into optionality which Jacobs (1994a) treated as a different lexical entry (and not as proper optionality), the case of verbs such as *treten* 'to kick', which can be interpreted as implying a "kicked object" (either realised or not) or also as not implying the "kicked object" (cf. Table 4.6).[109] The formalisation in (80) shows how this kind of verbs could be analysed as one single lexical entry with disjunct constraints. In order to do so, three further clauses in the lexical entry are needed, the first one for when the complement is realised (and implied), the second one for when the object is not realised but implied, and the third one for when the complement is neither realised nor implied.[110]

This formalisation shows how it is possible to account for three different lexical items with one single lexical entry. Furthermore, it includes the otherwise excluded lexical entry of verbs which omit their complements syntactically as well as semantically, cf. the case of the verb *treten* 'to kick'. On the other hand, this approach has also certain problems.

Firstly, one must ask what it means for a verb to have a specific semantic relation

[108] But see the description of the lexical system made by Bierwisch (1989: 2–8) with his distinctions between basic lexical entries, complex lexical entries, virtual lexical entries, and possible lexical entries.

[109] Müller (1999: 35) proposes also a treatment of *treten* as two different lexical entries, one with and one without the implied complement.

[110] This formalisation differs from the one offered in Pollard and Sag (1987: 133) and the more accurate in Müller (1999: 35) due to the different semantic frameworks used. I am using a simplistic variant of MRS and therefore, the internal structure of RELS here differs from its structure in Situation Semantics as used in the analyses just mentioned.

(80)
$$
\begin{bmatrix}
\text{PHON} & \langle \textit{tretet} \rangle \\
\text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{ARG-ST} & \boxed{6} \langle \boxed{1}\ \text{NP}[\textit{str}]_{\boxed{4}} \rangle \oplus \square \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{3}\ \textit{event} \\ \textit{mrs} & \end{bmatrix} \end{bmatrix} \\
\textit{stem} &
\end{bmatrix}
$$

$$\wedge .$$

$$
\begin{bmatrix}
\text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{VAL}|\text{COMPS} & \langle \boxed{2} \rangle \\ \text{ARG-ST} & \boxed{6} \oplus \langle \boxed{2}\ \text{NP}[\textit{str}]_{\boxed{5}} \rangle \end{bmatrix} \\ \text{CONT}|\text{RELS} & \left\langle \begin{bmatrix} \text{EVENT} & \boxed{3} \\ \text{AG} & \boxed{4} \\ \text{TH} & \boxed{5} \\ \textit{kick} & \end{bmatrix} \right\rangle \end{bmatrix}
\end{bmatrix}
$$

$$\vee$$

$$
\begin{bmatrix}
\text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{VAL}|\text{COMPS} & \langle\ \rangle \\ \text{ARG-ST} & \boxed{6} \oplus \langle \boxed{2}\ \text{NP}[\textit{str}]_{\boxed{5}} \rangle \end{bmatrix} \\ \text{CONT}|\text{RELS} & \left\langle \begin{bmatrix} \text{EVENT} & \boxed{3} \\ \text{AG} & \boxed{4} \\ \text{TH} & \boxed{5} \\ \textit{kick} & \end{bmatrix} \right\rangle \end{bmatrix}
\end{bmatrix}
$$

$$\vee$$

$$
\begin{bmatrix}
\text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{VAL}|\text{COMPS} & \langle\ \rangle \end{bmatrix} \\ \text{CONT}|\text{RELS} & \left\langle \begin{bmatrix} \text{EVENT} & \boxed{3} \\ \text{AG} & \boxed{4} \\ \textit{kick}' & \end{bmatrix} \right\rangle \end{bmatrix}
\end{bmatrix}
$$

such as the *kick* relation – or a specific intension as postulated as necessary in the definition of optionality given in (58). Does this relation also imply the fixed cardinality of semantic arguments, or does it only imply what the *maximal* cardinality possible for the relation can be (as suggested in Pollard and Sag 1987: 132)? One can go one step further and analyse cases like the causative-state alternation of verbs such as *hängen* 'to hang' in example (59) as alternative valence and content information, but this treatment would miss the generalisation and store this information hard-wired in the lexical entry. That is to say, the boundary between the (syntactic and semantic) argument reduction in *treten* is to some extent similar to alternation cases like the one posited by *hängen*, since not only valence but also content information must be altered, and in order to offer an adequate analysis without losing a generalisation a lexical rule would be the better way to go.[111]

Secondly, a further difficulty of a general treatment of optionality by means of disjunctions concerns the mapping between ARG-STR and VAL as outlined in Section 4.3.1.2. The generalisations captured by the constraints on verbal lexemes (cf. (32)) and their realisation types (cf. (33)) would be undermined by idiosyncratic mapping-postulates given in each lexical entry of a predicate with optional arguments (cf. for instance the solution postulated in Fodor and Fodor 1980).

Thirdly, as mentioned by De Kuthy and Meurers (2003: 90), depending on the cardinality of the optional arguments the complexity increases. For instance, in example (81) (their (1)), assuming that *bet* has three optional arguments, yields eight possible combinations of realised arguments (cf. (81a)–(81h)).

(81) a. Kim bet [Tom] [five dollars] [that they hired Cindy].
b. Kim bet [Tom] [five dollars].
c. Kim bet [Tom] [that they hired Cindy].
d. Kim bet [five dollars] [that they hired Cindy].
e. Kim bet [five dollars].
f. Kim bet [that they hired Cindy].

[111] Pollard and Sag (1987: 133–134) propose disjunction in the lexical entry for the *treten* case, and an analysis by means of lexical rules for cases such as *hängen*. Müller (1999: 35), on the contrary, suggests to analyse *treten* – in analogy to the more idiosyncratic cases of Eisenberg (2013: 61) presented in (60) – as two different lexical entries, and alternation by means of lexical rules (cf. Müller, 2016b). Remember that the feature geometry of elementary predications could be altered in Neo-Davisonian fashion in order not to change the elementary predication itself, but only its semantic arguments, see Footnote 89.

g. Kim bet [Tom].

h. Kim bet.

As they say, "[t]he brute-force method for licensing these structures would be to posit eight independent lexical entries for *bet*, one for each of the environments exemplified [. . .]". Taking their statement literally, the *brute-force method* would imply the proposed solution 4 on the list above.[112] Thus, the resulting descriptive complexity increases. In the disjunctive analysis (cf. 3 on the list), a special clause in the lexical entry of *bet* would have to be given for each of the possible combinations. Therefore, the descriptive complexity would just be shifted to the lexical entry not being captured by a generalisation as desired. The solution proposed by De Kuthy and Meurers (2003) is based on Flickinger (2000). In his analysis, Flickinger points out that

> [. . .] the choice between disjunction and type underspecification seemed entirely arbitrary from a descriptive viewpoint. (Flickinger, 2000: 18)

He favours an analysis of optionality by means of features and underspecification in the type hierarchy over an analysis of disjunctions in the lexical entry.[113] It is worth mentioning that Flickinger's analysis is not only led by the goal of linguistic adequacy, but also by efficiency in grammar implementation. Since the choice of type underspecification over disjunction reduces the processing costs, this is the right way to go – from the perspective of grammar implementation – as long as

[112] Since the LKB system used by De Kuthy and Meurers (2003) for grammar implementation does not make use of disjunction, they mean eight *lexical entries*, and not *lexical items* licensed by one lexical entry.

[113] Although Flickinger (1987) uses the disjunctive analysis, he already mentions the possibility to account for optionality by means of feature specifications, as he does in Flickinger (2000). This is shown by the following quote.

> It is worth noting here that the informal parenthesis notation used to indicate the optionality of the PP-By should more properly be represented as another attribute of each subcat, which I will assume is a Status attribute alongside the Features and Index attributes already illustrated for subcats. The possible values of this attribute would be at least Obligatory and Optional, but the attribute might also be used to distinguish several kinds of optionality.
> (Flickinger, 1987: 42)

the descriptive adequacy is not neglected. The difference between the approaches given in De Kuthy and Meurers (2003) and Flickinger (2000) is due to the capacities of the respective implementation systems. While De Kuthy and Meurers' system is able to support relational constraints such as *append*, Flickinger's system is not (cf. De Kuthy and Meurers, 2003: 92). Hence, this distinction between both systems can be considered as a kind of "theory-internal distinction" – similar to the use/avoidance of movement or empty categories – and leads to an increase of phrasal types in Flickinger's solution at cost of the descriptive adequacy.

But there is one problem in both approaches which I am trying to amend here. Both approaches do not make a distinction between different classes of optionality. That is to say, they treat all optional arguments as if they were like the optional argument of *heiraten* 'to marry' (cf. Table 4.6). Since their main focus lay on the adequate syntactic discharge of optional arguments, they do not provide adequate descriptions of the further contexts which license the omission of optional arguments. In the following section, I am offering an account for the distinct subclasses of optionality which were discussed so far.

4.4.3 Accounting for subclasses of optionality

The solution posit here makes use of the extended feature geometry proposed in (19) in Section 4.2 and repeated here as (82).

(82)
$$\begin{bmatrix} \text{SYNSEM}|\text{LOC}|\text{CAT} & \begin{bmatrix} \text{VAL} & \begin{bmatrix} \text{SUBJ} & \left\langle \boxed{1} \begin{bmatrix} \text{ARG} & \textit{synsem} \\ \text{RSD} & \textit{bool} \\ \textit{arg} & \end{bmatrix} \right\rangle \\ \text{COMPS} & \left\langle \boxed{2} \begin{bmatrix} \text{ARG} & \textit{synsem} \\ \text{RSD} & \textit{bool} \\ \textit{arg} & \end{bmatrix}, \boxed{3} \begin{bmatrix} \text{ARG} & \textit{synsem} \\ \text{RSD} & \textit{bool} \\ \textit{arg} & \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1}, \boxed{2}, \boxed{3} \right\rangle \end{bmatrix} \\ \textit{word} & \end{bmatrix}$$

As (82) shows, arguments are listed in the VAL lists and the ARG-ST list. This is a difference between the analyses brought by Flickinger (2000) and De Kuthy and Meurers (2003) on the one hand, and the current account on the other hand. Furthermore, arguments are of type *arg*, which is further specified through the attributes ARG and RSD. Following a proposal made in Flickinger (1987: 42) (cf. Footnote 113), I am including a STATUS feature (STTS). This new feature[114] is introduced as an attribute of the *arg* type and is *status* valued. Figure 4.9 provides the type hierarchy for *status* which is based on the optionality distinctions described in Section 4.4.1. Thus, the single possible values for STTS can be used as follows:

- *nopt*: for not optional – i.e. obligatory – arguments;
- *opt*: for optional arguments;
- *opt_pure*: for optional arguments without further restrictions (cf. *heiraten*);
- *opt_est*: for optional arguments which must be established (cf. the definition in 65 and *einwilligen*);
- *opt_pcl*: for optional arguments which must be particularised (cf. the definition in 72 and *geben*); and
- *opt_est_pcl*: for optional arguments which must be established and particularised (cf. *akzeptieren*).

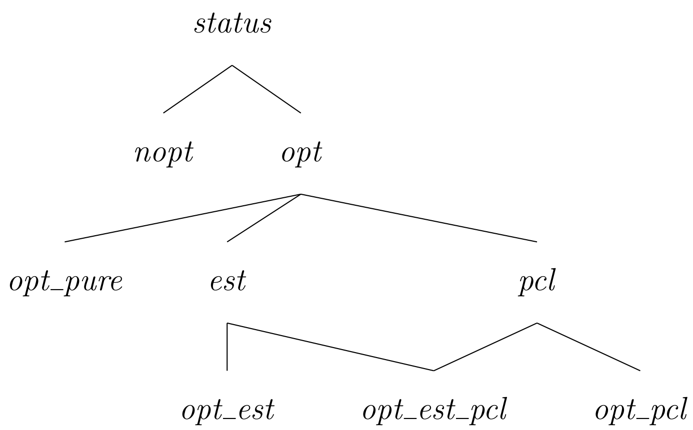

Figure 4.9: Type hierarchy for status

With these new attribute-value pairs, it is possible to distinguish the different kinds of optionality discussed in Section 4.4.1, and not only between optional vs.

[114]Flickinger (2000) and De Kuthy and Meurers (2003) make use of a *bool* valued OPTIONAL attribute inside the *synsem* of the arguments, since they only distinguish between optional (OPT +) and obligatory (OPT −) arguments.

not-optional. Now, each lexical entry will state if it has obligatory or optional arguments, and *under which circumstances* the omission of the (optional) argument can take place. Moreover, with this method, it is possible to mark each argument of a predicate with a different type of optionality, if this is needed. For instance, the verb *verkaufen* 'to sell' seems to have one optional argument of type *opt_pure*, and one of type *opt_est*. Thus, in example (83b) 'to whom something is being sold' does not have to be established, but 'what is being sold' must.[115]

(83) a. Ich verkaufe [der Bank]$_{opt}$ [mein Haus]$_{opt\_est}$.
I sell the bank my house

b. Ich verkaufe.
I sell

Furthermore, I am dividing the type *arg* into two further subtypes (cf. Figure 4.10): *argument_expressed* (*arg_exp*) and *argument_not_expressed* (*arg_nexp*). That is, in a lexical entry, the arguments are listed in the ARG-ST list as being of type *arg*. When an argument has been discharged from one of the VAL lists by means of an ID-schema (e.g. in a *head-complement-structure*), then the *arg* value of the discharged argument must be specified as *arg_exp*,[116] but if the argument has been omitted they are marked as *arg_nexp*. Thus, it can be constrained that only arguments with the STTS value *opt* (or a subtype of it) can be specified as *arg_nexp*. This distinction can be productive for further phenomena, for example for anaphoric reference making a distinction between the behaviour of expressed and unexpressed arguments.

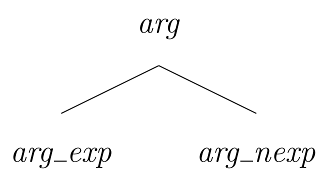

Figure 4.10: Type hierarchy for argument

Now, in order to discharge the omitted optional arguments, I make use of *unary*

[115]Instead of stating in each lexical entry what kind of arguments it has, it is possible to state verbal constraints yielding generalisations on verb types similar to the ones proposed in Section 4.3.1.2. I do not go deeper into this, but I think that it is a promising way to go.

[116]This marking should be implemented in the respective ID-schemata.

syntactic rules (USyn-rules).[117] In Flickinger (2000: 23), this method is mentioned, but not preferred due to higher efficiency costs in comparison to an approach by means of a multiple inheritance for the hierarchy of the type *list*. As already mentioned, the approaches given in Flickinger (2000) and De Kuthy and Meurers (2003) are only committed to an adequate description of *syntactic* discharging of optional arguments. They both do not take semantic/pragmatic factors into consideration. But including the semantic/pragmatic factors into the analysis, a plain syntactic solution cannot be given, since depending on the type of optionality at hand different additional restrictions must be included into the semantic/pragmatic part of the structure. Therefore, I propose to make use of USyn-rules, which take an object of type *word_or_phrase* with a specific valence and discharge one of the optional arguments, adding some restrictions to the semantics/pragmatics of the sign if necessary.

Firstly, a USyn-rule to discharge optional arguments *in general* is given in (84).[118] This rule takes a word or phrase as input. The first element of the input's COMPS list (cf. $\boxed{1}$) is structure-shared with one element of the ARG-ST list specified as being of type *arg* and with the attribute-value pair: STTS *opt*. In the output of the rule, the COMPS list is reduced by the optional argument (cf. $\boxed{1}$), and the value of the *arg* object in the input has been specified as *arg_nexp*. This rule can apply recursively, as long as there are objects in the COMPS list, and can be used to reduce optional arguments of predicates such as *heiraten* 'to marry' which do not have to be licensed by further semantic/pragmatic constraints.

For optional arguments which must be established in order to be omitted, further information is needed. In Section 2.4, the CONTEXT attribute (CONX) was introduced but not further explained. Now, this attribute (cf. (85)) will be used to account for a special kind of optionality. CONX is a *context* valued attribute which contains pragmatic information. In Pollard and Sag (1994: 27), it is defined as having the attributes BACKGROUND (BG) and CONTEXTUAL-INDICES (C-INDS). The value of BG is a *set* of relations similar to RELS in CONT,[119] but in contrast

[117] USyn-rules are comparable to the deletion transformations mentioned in Chomsky (1964) and Katz and Postal (1964). The distinction between both being the complex mechanisms needed for the latter, but not for the former.

[118] The attribute SYNSEM is abbreviated with SS due to lack of space.

[119] Take into account, that CONT is a *list* of relations, while BG is a *set* of relations. The notation for *sets* is represented by curly brackets (i.e. { }).

(84) Unary Syntactic Rule for *opt*

$$\left[\begin{array}{ll}
\textsc{ss}|\textsc{loc} & \left[\begin{array}{ll}\textsc{cat} & \left[\begin{array}{ll}\textsc{val} & \left[\begin{array}{ll}\textsc{comps} & \boxed{2}\end{array}\right] \\ \textsc{arg-st} & \boxed{3}\ \mathit{list} \oplus \left\langle \left[\begin{array}{l}\textsc{arg}\ \boxed{7} \\ \textsc{stts}\ \boxed{8} \\ \mathit{arg_nexp}\end{array}\right] \right\rangle \oplus \boxed{2}\ \mathit{list}\end{array}\right]\end{array}\right] \\
\textsc{hd-dtr} & \left[\begin{array}{ll}\textsc{ss}|\textsc{loc} & \left[\begin{array}{ll}\textsc{cat} & \left[\begin{array}{ll}\textsc{val} & \left[\begin{array}{ll}\textsc{comps} & \left\langle \boxed{1} \right\rangle \oplus \boxed{2}\end{array}\right] \\ \textsc{arg-st} & \boxed{3}\ \mathit{list} \oplus \left\langle \boxed{1} \left[\begin{array}{l}\textsc{arg}\ \boxed{7} \\ \textsc{stts}\ \boxed{8}\ \mathit{opt} \\ \mathit{arg}\end{array}\right] \right\rangle \oplus \boxed{2}\ \mathit{list}\end{array}\right]\end{array}\right] \\ \mathit{word_or_phrase} & \end{array}\right] \\
\mathit{del_opt_ur} &
\end{array}\right]$$

to the value of the latter, which represents *truth-conditional restrictions* of the constrained objects, the value of CONX states the *felicity conditions* of the object. That is to say, in CONX, the conditions for presuppositions and conventional implicatures are given. C-INDS entails information about the contextually introduced discourse referents SPEAKER, ADDRESSEE, and UTTERANCE-LOCATION (U-LOC) (cf. Pollard and Sag, 1994: 335–337).

(85)

$$\left[\begin{array}{ll}
\textsc{conx} & \left[\begin{array}{ll}\textsc{c-inds} & \left[\begin{array}{ll}\textsc{speaker} & \mathit{ref} \\ \textsc{addressee} & \mathit{ref} \\ \textsc{u-loc} & \mathit{ref}\end{array}\right] \\ \textsc{dr} & \mathit{list(index)} \\ \textsc{bg} & \left\{\left[\mathit{rel}\right]\right\} \\ \mathit{context} & \end{array}\right]
\end{array}\right]$$

I am expanding Pollard and Sag's feature geometry of CONX by one further attribute DISCOURSE-REFERENTS (DR). The value of DR is a list of established discourse referents, which collects all indices which have been introduced in the discourse (cf. (87)), among others also the values of SPEAKER, ADDRESSEE, and U-LOC (cf. (85)). According to Pollard and Sag (1994: 333), the information in BG is projected by means of the so-called *Principle of Contextual Consistency* (CoCoP), in order to keep the list of discourse referents updated and accessible for anaphoric reasons, I am expanding the CoCoP so as to project not only the value of BG, but also of DR, as formulated in (86).[120]

(86) Principle of Contextual Consistency (CoCoP)
The CONX|BG value of a phrase is the union of the CONX|BG values of the daughters; and the CONX|DR value of a phrase is the append of the CONX|DR values of the daughters.

The value of the DR attribute results from collecting the values of the DR lists of the daughters and their IND values. This is achieved by the Discourse Referent Principle (DRP) as proposed in (87).

(87) Discourse Referent Principle (DRP)
The CONX|DR value of a phrase is the append of the CONX|DR values of the daughters and their CONT|IND values.

With this short introduction to the CONX attribute, and the expansion of its feature geometry by DR, of the CoCoP for the value of DR, and with the proposed DRP, the USyn-rule to discharge optional arguments which are licensed only if they have been established in the discourse can be given as in (88).

The USyn-rule in (88) takes as input a word or phrase with an element in its COMPS list whose STTS value is *opt_est*. In the output of this rule, the COMPS list is reduced by the *opt_est* argument, and the *arg* value is further specified as *arg_nexp*. Moreover, this rule introduces a felicity condition in BG, namely an *established_relation* (*est_rel*), which states that the index of the optional argument that is omitted (cf. $\boxed{4}$) must be a member of the list of established discourse referents (cf. $\boxed{5}$).[121] In order to check, whether the omitted argument is part of the list of discourse referents, I am using the `member` function as explained in (36b) in Section 4.3.1.2.

For optional arguments that require to be particularised, it is necessary to adopt a different strategy from USyn-rules alone. The problem with particularised optional arguments is that it is not possible to deduce which further semantic/pragmatic characteristics the objects must have through a generalisation. For instance,

[120] Unlike lists which are built by means of append (⊕), sets are concatenated by means of the relational constraint *union* (∪).

[121] In order to be more accurate, a theory of discourse must be introduced into the HPSG architecture such that these relations can be checked at the level of discourse since the sentence level is not a sufficient domain to check the establishment of a discourse referent.

(88) Unary Syntactic Rule for *opt_est*

$$
\left[\begin{array}{ll}
\textsc{ss}|\textsc{loc} & \left[\begin{array}{ll}
\textsc{cat} & \left[\begin{array}{ll}
\textsc{val} & \left[\textsc{comps}\ \boxed{2}\right] \\
\textsc{arg-st} & \boxed{3}\ \mathit{list} \oplus \left\langle \left[\begin{array}{l} \textsc{arg}\ \boxed{7} \\ \textsc{stts}\ \boxed{8} \\ \mathit{arg\_nexp} \end{array}\right] \right\rangle \oplus \boxed{2}\ \mathit{list}
\end{array}\right] \\
\textsc{conx} & \left[\begin{array}{ll}
\textsc{c-inds}|\textsc{dr} & \boxed{5} \\
\textsc{bg} & \boxed{6} \cup \left\{ \left[\begin{array}{l} \textsc{ind}\ \boxed{4} \\ \mathit{est\_rel} \end{array}\right] \right\}
\end{array}\right]
\end{array}\right] \\
\textsc{hd-dtr} & \left[\begin{array}{l}
\textsc{ss}|\textsc{loc} \left[\begin{array}{ll}
\textsc{cat} & \left[\begin{array}{ll}
\textsc{val} & \left[\textsc{comps}\ \left\langle \boxed{1} \right\rangle \oplus \boxed{2}\right] \\
\textsc{arg-st} & \boxed{3}\ \mathit{list} \oplus \left\langle \boxed{1} \left[\begin{array}{ll} \textsc{arg}\ \boxed{7} & \left[\begin{array}{l} \textsc{ind}\ \boxed{4} \\ \mathit{synsem} \end{array}\right] \\ \textsc{stts}\ \boxed{8} & \mathit{opt\_est} \\ \mathit{arg} & \end{array}\right] \right\rangle \oplus \boxed{2}\ \mathit{list}
\end{array}\right] \\
\textsc{conx} & \left[\begin{array}{ll}
\textsc{c-inds}|\textsc{dr} & \boxed{5} \\
\textsc{bg} & \boxed{6}
\end{array}\right]
\end{array}\right] \\
\mathit{word\_or\_phrase}
\end{array}\right] \\
\mathit{del\_opt\_est\_ur} &
\end{array}\right]
$$

$$\wedge\ \boxed{4} = \texttt{member}(\boxed{5})$$

the fact that the omitted arguments of *geben* 'to give' in (74) must be card players and playing cards cannot be generalised and is an idiosyncratic characteristic of the verb.[122] In these cases it is therefore necessary to use disjunctions in the lexical entries as proposed by Jacobs (1994a). But in contrast to the proposal in Jacobs (1994a: 301), it is not necessary to give three different disjunctive constraints just for the optional arguments, one for each possible combination of (not-)omitted arguments – i.e. four entries in total. Using the USyn-rule proposed in (84) combined with the disjunctive lexical entry in (89), only two disjunctive constraints are needed, one for non-optional arguments and one for optional ones.

The lexical entry in (89) states an underlying part of the entry which contains the non-optional subject (cf. $\boxed{1}$) and the *give* relation with all its theta-roles: AG, TH, and BENEFACTOR (BEN). The first part of the disjunction constrains the further arguments (cf. $\boxed{2}$ and $\boxed{3}$) as *nopt*. On the contrary, the second part of the disjunction constrains these arguments as *opt_pcl* and adds the further constraint that $\boxed{5}$ and $\boxed{7}$ must be card players and $\boxed{6}$ playing cards, that is their semantic particularisation. Now, since the USyn-rule in (84) holds for elements which are of type *opt*, and *opt_pcl* is a subtype of it, this rule can apply in order to discharge the optional arguments. But if it is the case, that this rule applies, only the second part of the disjunction can be used, instantiating the "card game" reading of the verb.

In this section, it has been shown how to account for different classes of optionality without losing the intuitive relation between *lexical items* that would result when applying the "brute-force method" of assuming a single *lexical entry* for each distinction in a valence list.

The different classes of optionality according to Jacobs (1994a) and defined in (58) have been exemplified in the last sections and summarised in Table 4.6, repeated and completed here in Table 4.7.

The intuition that in the first five classes (i.e. *heiraten* 'to marry', *einwilligen* 'to agree', *geben* 'to give', *akzeptieren* 'to accept', and *treten* 'to kick'), we are dealing

[122] Another possible meaning of optional arguments with the predicate *geben* 'to give' is the one given in (i) in which the first optional argument is *opt_pcl* and the second one *opt_pure*, and which can be treated straightforwardly with the mechanisms provided here.

(i) Er gibt ([den Kindern]$_{\text{opt\_pure}}$) gern ([Geld]$_{\text{opt\_pcl}}$).
he gives the children willingly money
'He is happy to donate money for children.'

(89)
$$
\begin{bmatrix}
\text{PHON} & \langle \textit{gibt} \rangle \\
\text{SS}|\text{LOC} & \begin{bmatrix}
\text{CAT} & \begin{bmatrix}
\text{HEAD} & \begin{bmatrix} \textit{verb} \end{bmatrix} \\
\text{VAL} & \begin{bmatrix} \text{SUBJ} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle \boxed{2}, \boxed{3} \rangle \end{bmatrix} \\
\text{ARG-ST} & \left\langle \boxed{1} \begin{bmatrix} \text{ARG} & \begin{bmatrix} \text{IND } \boxed{5} \\ \textit{synsem} \end{bmatrix} \\ \text{STTS} & \textit{nopt} \\ \textit{arg} & \end{bmatrix} \right\rangle \oplus \boxed{10}
\end{bmatrix} \\
\text{CONT} & \begin{bmatrix}
\text{IND} & \boxed{4}\ \textit{event} \\
\text{RELS} & \boxed{8} \left\langle \begin{bmatrix} \text{EVENT} & \boxed{4} \\ \text{AG} & \boxed{5} \\ \text{TH} & \boxed{6} \\ \text{BEN} & \boxed{7} \\ \textit{give} & \end{bmatrix} \right\rangle \oplus \square \\
\textit{mrs} &
\end{bmatrix}
\end{bmatrix} \\
\textit{word} &
\end{bmatrix}
$$

$$\wedge.$$

$$
\begin{bmatrix}
\text{SS}|\text{LOC}|\text{CAT}|\text{ARG-ST} \ \square \oplus \boxed{10} \left\langle \boxed{2} \begin{bmatrix} \text{ARG} & \begin{bmatrix} \text{IND } \boxed{6} \\ \textit{synsem} \end{bmatrix} \\ \text{STTS} & \textit{nopt} \\ \textit{arg} & \end{bmatrix}, \boxed{3} \begin{bmatrix} \text{ARG} & \begin{bmatrix} \text{IND } \boxed{7} \\ \textit{synsem} \end{bmatrix} \\ \text{STTS} & \textit{nopt} \\ \textit{arg} & \end{bmatrix} \right\rangle
\end{bmatrix}
$$

$$\vee$$

$$
\begin{bmatrix}
\text{SS}|\text{LOC} & \begin{bmatrix}
\text{CAT}|\text{ARG-ST} \ \square \oplus \boxed{10} \left\langle \boxed{2} \begin{bmatrix} \text{ARG} & \begin{bmatrix} \text{IND } \boxed{6} \\ \textit{synsem} \end{bmatrix} \\ \text{STTS} & \textit{opt\_pcl} \\ \textit{arg} & \end{bmatrix}, \boxed{3} \begin{bmatrix} \text{ARG} & \begin{bmatrix} \text{IND } \boxed{7} \\ \textit{synsem} \end{bmatrix} \\ \text{STTS} & \textit{opt\_pcl} \\ \textit{arg} & \end{bmatrix} \right\rangle \\
\text{CONT}|\text{RELS} \ \boxed{8} \oplus \left\langle \begin{bmatrix} \text{CARD\_PLAYER1} & \boxed{5} \\ \text{PLAYING\_CARD} & \boxed{6} \\ \text{CARD\_PLAYER2} & \boxed{7} \\ \textit{card\_game} & \end{bmatrix} \right\rangle
\end{bmatrix}
\end{bmatrix}
$$

VERB		EST	PCL	IMPLIED ARGUMENT	SAME INTENSION	OPT
heiraten	'to marry'	–	–	+	+	+
einwilligen	'to agree'	+	–	+	+	+
geben	'to give'	–	+	+	+	+
akzeptieren	'to accept'	+	+	+	+	+
treten	'to kick'	–	–	–	+	–
entbinden	'to give birth' 'to discharge'	–	–	–	–	–

Table 4.7: Categorisation of optionality (extended)

with only one element in each case – i.e. lexical entry – although there are distinct realised valences can be described adequately.

Furthermore, due to the distinction in the STTS values, it has been made possible to distinguish between the different kinds of licensing contexts for omitted optional arguments in the cases of *heiraten* 'to marry', *einwilligen* 'to agree', *geben* 'to give', *akzeptieren* 'to accept'. Thus, the notion of "optional argument" given by Jacobs (1994a) and summarised in (58) can be retained as it was, and its descriptive adequacy can be enhanced by means of the HPSG formalisation just given.

For cases such as *treten* 'to kick', the analysis captures the intuition that there is a relation between the transitive form and its intransitive counterpart which is not captured when assuming two separate lexical entries. Both lexical items, i.e. the transitive and the intransitive one, can be related either by means of a lexical rule deleting one element from the ARG-ST list and one from the *kick* relation, or by means of disjunctive constraints in one single lexical entry.[123] In either case, a similarity to the treatment of optional arguments is preserved, without treating it as optionality according to the definition in (58).

On the other hand, for cases such as *entbinden* 'to give birth' / 'to discharge', an analysis by means of two different lexical entries is more adequate (cf. Eisenberg 2013: 62 and Müller 1999: 35), since here a synchronic relation between both entries is not given any more, and their distinction is clearly based upon idiosyncratic factors.

Moreover, it could be avoided to account for optionality using empty categories (as suggested in Grewendorf (1995)). Although, this method would have been able

[123] The solution via lexical rule should be preferred, since this kind of detransitivation is a regularity and not an idiosyncrasy. But remember Footnote 89!

to account for optionality in the cases of "pure optionality" (cf. *heiraten* 'to marry') or of "established arguments" (cf. *einwilligen* 'to agree') assuming one different sort of *pro* element for each case, it would not have been able to account for the other cases which demand much more interaction with the lexicon, deleting or adding material to the lexical entry (cf. *treten* 'to kick', *akzeptieren* 'to accept', and *geben* 'to give').[124]

Similar to the accounts provided by Flickinger (2000) and De Kuthy and Meurers (2003), the present account diminishes the complexity in the lexical entries resulting from Pollard and Sag (1987) and Jacobs (1994a). Disjunctions in lexical entries are only necessary for optional arguments with the STTS value *pcl* (and its subtypes) as their semantics is not generalisable. This reduction of complexity does not give up Jacobs's requirement to encode optionality in the lexicon (in contrast to syntactically licensed omissions like topic-drop), but it avoids the linguistically unmotivated complexity of lexical entries when possible, e.g. for arguments marked with STTS values *est* and *opt_pure* (see Jacobs 2003: 393 for the opposite position). But in contrast to Flickinger (2000) and De Kuthy and Meurers (2003), the present analysis accounts for different classes of optionality, making the distinction more fine-grained and descriptively more adequate.

To conclude, all distinctions of optionality classes can be accounted for in one and the same framework, HPSG. That is to say, it is not necessary to use different grammatical systems for regular or core cases of optionality, e.g. the optional arguments of *heiraten* 'to marry', or for more idiosyncratic or peripheral cases, e.g. optional arguments of *geben* 'to give'.[125] The mechanisms provided by HPSG are able to deal with regularities as well as with idiosyncrasies, revealing the commonalities and differences with respect to the degree of grammaticality/oddness by means of commonalities and differences in the attribute-value pairs of the signs. This fact makes HPSG a very powerful framework in order to account for the whole range of data.

[124] Nevertheless, the use of empty categories could be useful in order to account for argument omission in cases such as topic-drop.

[125] Take into account that in a framework such as MGG, s-selectional features are not included into the scope of analysis. Moreover, in MGG they are a matter of lexical semantics with semantics being not a driving force for syntactic operations (cf. Adger, 2004: 89–90) (at least in MGG after Chomsky 1965). That is to say, optionality as it has been treated here is not a phenomenon that can be analysed in MGG.

4.5 Optionality in NPs

The optionality assumption for *all* arguments of an NP is not uncommon (cf. Bierwisch 1989: 7; Hartmann and Zimmermann 2003: 188; Bierwisch 2009: 291 & 301; a.o.)[126] – in contrast to their verbal counterparts as shown in the last section, and it seems intuitively right to postulate it (cf. Barker, 2011: 1111). Nonetheless, it is a much discussed topic in the literature comprising different positions on this and further topics closely related to the optionality issue (cf. Bierwisch 1989; Grimshaw 1992; Ehrich and Rapp 2000; Hartmann and Zimmermann 2003; Alexiadou et al. 2007; Bücking 2010; Solstad 2010; Bücking 2012). In the following, I will show some of the controversially discussed positions.

Firstly, there are diverging points of view with respect to the argumental status of post-nominal NPs in genitive.

1. Post-nominal NPs in genitive are arguments; vs.
2. post-nominal NPs in genitive are adjuncts/modifiers (cf. Solstad, 2010).

I am assuming 1, if the elements in question take on the role of semantic arguments fulfilling the theta-role given by the head noun (cf. Section 3.2.1.3). For them, it holds that their case assignment can be described by means of a generalised CaseP as shown in Section 4.2. Furthermore, the nominalisation behaves parallel to the verbal case of passivisation (cf. Section 4.3.1). Thus, it seems justified to describe post-nominal NPs in genitive as arguments rather than adjuncts, provided they meet the conditions just mentioned. But sometimes, a distinction is also made with respect to *some* arguments.

3. Agentive and thematic NPs in genitive are considered as arguments; vs.
4. agentive genitive NPs are modifiers, only thematic genitive NPs are arguments (cf. Hartmann and Zimmermann 2003; Bücking 2012).

I am assuming 3, although it must be taken into consideration that there exists indeed a difference between the agent and the theme of a predicate. See the

[126] Notice that the "general optionality" assumed here is mentioned – if at all – with caution. For instance, Hartmann and Zimmermann (2003: 8) say that "[...] the realisation of arguments is (*almost*) always optional", while Bierwisch (1989: 7) states that the arguments within NPs "[...] are *normally* optional" [Emphasis added; MyP]. Since idiosyncrasies can be found in every part of grammar (cf. Footnote 130), this caution can be considered well founded.

USyn-rule proposed in (133) to account for this distinction.[127] This distinction has been made not only for NPs, but mostly for VPs, analysing the "subject" of the predication as an argument of a further functional phrase (for instance of VoiceP in Kratzer 1996 which is the most prominent analysis in this direction). Moreover, assuming 1 and 3, the question remains whether,

5. arguments of NPs are optional; vs.

6. arguments of NPs are in some cases obligatory (cf. Grimshaw 1992; Bücking 2010).

Assuming 1 and 3, it is necessary as well to assume that (at least some) arguments in NPs must be optional, but this does not automatically infer that some arguments can(not) be obligatory. In the following, I am going to discuss and give arguments for 1, 3, and 5.

The first distinction to be made in order to account for the optionality issue of NPs has to do with the distinction between *relational nouns* and *sortal nouns*.[128] The semantic distinction between both classes of nouns lies in the fact, that while sortal nouns denote one-place relations (cf. (90a)), relational nouns denote two place relations (cf. (90b)). The relations established by relational nouns are of many kinds, for example: kinship (e.g. *sister*), related to social relations (e.g. *friend*), to part-whole relations (e.g. *coast*), to content-container relations (e.g. *glas*), etc. (cf. Fabricius-Hansen 1987; RAE, 2010a: 857; a.o.).[129] That is to say, sortal nouns

[127] The terms *agent* and *theme* should be read as *proto-agent* and *proto-patient* in the sense of Dowty (1991: 571–572) (a similar distinction was proposed by Keenan (1976) with his universal (though relative) definition of 'subject'). More adequate terms – because more neutral with respect to the theta-roles – are actually external and internal argument. This terminology presupposes though a configurational syntax which is not adopted in HPSG. Normally, I am going to use the terms *agent* and *theme*, though sometimes, to avoid the conflict with other theta-roles such as experiencer or stimulus, I am going to use *external* and *internal argument*.

[128] In the literature, sortal nouns are sometimes called *absolute nouns* (cf. Fortmann, 1996: 35). Following Barker (2011), I am using the former terminology.

[129] It is indeed not always easy to distinguish between sortal nouns and relational nouns. For instance, while a noun such as *daughter* is always taken as a relational noun, *child* is less clear with respect to its classification (cf. Fortmann 1996: 37 and also Bücking 2012: 83–84, who classifies *child* primarily as sortal. Furthermore, in his analysis, Bücking treats genitive NPs of non-eventive relational nouns as modifiers, and not as arguments, in contrast to the representation given in (90b).).

state a simple set of individuals (represented by the referential variable x in (90a)), and do not have further arguments, while relational nouns state a relation between individuals (in (90b) a relation between y and the referential variable x), thus denoting sets of pairs of individuals (cf. Barker, 2011: 1111).

(90) a. $[\![\text{table}]\!] := \lambda x\ .\ x$ is a table

b. $[\![\text{sister}]\!] := \lambda y \lambda x\ .\ x$ is a sister of y

For instance, example (90a) states that the sortal noun *table* denotes the set of entities x such that they are tables. On the other hand, example (90b) states that the relational noun *sister* denotes a relation between two entities x and y, such that x is a sister of y – or more accurately: *sister* denotes a function from entities y to a function from entities x to truth values, which is true iff x is a sister of y (cf. Heim and Kratzer, 1998: 63–64). Consequently, at least at a semantic level, relational nouns imply the existence of a further entity, and since this implication is one of the diagnostics for arguments (cf. Section 3.2.1), it can be stated that relational nouns do have arguments,[130] while sortal nouns do not. Strictly speaking, sortal nouns do have an argument. For instance, in example (90a), the variable x is a semantic argument of the predicate *table*. This variable determines to which sort of entity the predicate will refer (e.g. entities, events, etc.), thus being called the *referential argument* of the predicate (cf. Bierwisch, 1989: 6–7) – the same holds for the x variable of *sister* in example (90b). When talking about "arguments" in general, I am not referring to the referential arguments, since they do not behave as syntactic arguments, not being satisfied, but rather being bound by quantifiers or other operators.

Due to the fact that both – sortal nouns and relational nouns – in German and Spanish are able to take (post-nominal) genitive attributes, it is difficult to distinguish between the *argument* NPs in genitive and the *adjunct* NPs in genitive from a syntactic point of view (cf. examples (91a) and (91b) vs. (92a) and (92b)).

[130] In addition, some nouns – although very few – can have obligatory arguments (cf. Barker, 2011: 1111) as the examples in (i) show. Admittedly, some of them are grammaticalised elements which are now treated rather as (complex) prepositions or idiomatic expressions than as nominal elements (cf. Footnote 126).

(i) a. the *sake* of John

b. en *aras* de nuestra amistad
in interest of our friendship
'for the sake of our friendship'

That is to say, for an adnominal NP to be in genitive is not a sufficient condition to be classified as argument. But this is actually also the case for some NPs in nominative and accusative within VPs, this being the reason to assume that the types *nom*, *acc*, and *gen* have not only structural but also lexical subtypes (cf. Figure 4.1 in Section 4.2). Furthermore, (most) genitive attributes which could be considered arguments of relational nouns in both languages can be omitted (cf. Footnote 130) without affecting the grammaticality of the phrase. Hence, neither the presence nor the absence of a genitive attribute seems to give us a hint towards its (non-)argumental status. In contrast, English makes here a syntactic distinction, allowing post-nominal *of*-phrases with relational nouns but not with sortal nouns, as examples (91c) and (92c) show (cf. Barker, 2011: 1112–1113).

(91) a. Die *Schwester* (der Frau) arbeitet viel.
the sister the.GEN woman works a lot

b. La *hermana* (de la mujer) trabaja mucho.
the sister of the woman works a lot

‘The sister (of the woman) works a lot.’

c. The *sister* (of the woman) works a lot.

(92) a. Das *Tier* (der Frau) ist müde.
the animal the.GEN woman is tired

b. El *animal* (de la mujer) está cansado.
el animal of the woman is tired

‘The (woman’s) animal is tired.’

c. * The *animal* of the woman is tired.

For deverbal nominals – which are a subkind of relational nouns due to their capacity of creating a relation between two (or more) entities – the situation is similar. Deverbal nouns (normally) inherit the argument structure of their verbal stems (cf. Bierwisch 1989: 11–14; Barker 2011: 1124; a.o.), but there are different forms in which they can reflect the argument structure of the verbal base. Depending on the kind of derivation relating the verbal base to the derived noun, the nominal derivative can have inherited all open argument positions as in examples (93) and (94), but it is also possible that by virtue of the derivation, one of the open positions in the verb is not available any more as is the case for the agent in example (95) (cf. Bierwisch 2009: 303). For the derivative to inherit (all) argumental positions, implies neither that these *must* be syntactically realised, nor that they (all simultaneously) *can* be syntactically realised. Remember that in German and Spanish, only one post-nominal genitive is allowed, as it was explained with the constraint (35) and its discussion in Section 4.3.1.2.

(93) a. das *Bearbeiten* { des Angestellten / des Films }
b. el *adaptar* { del empleado / (de) la película }
'the employee's editing' and
'the editing of the film'

(94) a. die *Bearbeitung* { des Angestellten / des Films }
b. la *adapción* { del empleado / de la película }
'the edition of the employee' and
'the edition of the film'

(95) a. der *Bearbeiter* { *des Angestellten / des Films }
b. el *adaptador* { *del empleado / de la película }
'*the editor of the employee' and
'the editor of the film'

In examples (93), (94), and (95), the phrases *the employee* and *the film* were chosen in order to enforce the intended readings as agent and theme, respectively (cf. Footnote 127). This does not mean that only animate elements can be interpreted as agents, or only inanimate as themes, but they are more likely to be interpreted as such.[131] The contrast between (93) and (94) on the one hand, and (95) on the other hand, provides in addition evidence for the argumental status of the agent. Namely, the fact that the agent-reading of *the employee* is present in (93) and (94) suggest the existence of this theta-role in the argument structure of the nouns. What is more, the nouns *Bearbeiter* and *adaptador* represent so-called agent nominalisations, that is, these nouns actually already denote the agent of the predicate, by virtue of making the variable for the agent the referential argument. Semantically, this modification can be achieved by *Functional Composition* taking the variable for the agent to be the referential variable of the derivative.[132] Thus in (95), the agent-reading of *the employee* is not available any more. The fact that this argument can be made unavailable – by virtue of a systematic derivation –

[131] For further English examples and distinct conclusions with respect to the analyses, see for instance Di Sciullo and Williams (1988: 39–41) and Grimshaw (1992: 67) vs. Taylor (1994: 214–218).

[132] Cf. for further details Di Sciullo and Williams (1988: 34–41) and Bierwisch (2009: 303).

reinforces the intuition that it must have been available at some point.[133] In addition, the examples (93)–(95) show further how the *kind of derivation* influences the inheritance of the argument structure, and therefore also the related issue of the optionality, since for instance in (95) the agent argument cannot be seen as optional due to the fact that it has been made unavailable through the derivation, to be more specific: through the affixes *-er*/*-or*, respectively (cf. for instance, Bierwisch 1989; Bierwisch 2009; Alexeyenko 2011; Alexiadou and Schäfer 2010; a.o.).

Now, going back to the event nominalisations in (93) and (94). In Spanish and German, a verbal action can be nominalised by means of derivation yielding event nouns (also called nomina actionis, cf. Motsch 1999: 321; Eisenberg 2000: 266–268; RAE, 2010a: 338; a.o.). On the one hand, the infinitive form of a verb can be nominalised (cf. (93)),[134] or the derivation can be effected by means of the affixes *-ung* in German or *-ción*/*-miento* in Spanish (cf. (94)). Although both kinds of nominalisations share some aspects of their meaning (cf. (96a) vs. (97a)), they are not completely equivalent, neither morphosyntactically nor semantically speaking. For instance, the infinitive nominalisations in (93) are less constrained with respect to their base and their interpretation is more related to the "process" reading, while the event nominalisations with *-ung*/*-ción* in (94) can have not only the process reading, but also achievement or result/object readings, as it is shown with the Spanish examples in (96) and (97).[135]

(96) a. El *traducir* (de) la película está demorando bastante.
the translate.INF of the film is prolongating a lot
'The translating (of) the film is taking a lot.' [process]

b. * El *traducir* (de) la película se realizó en cinco días.
the translate.INF of the film REFL realised in five days
'The translation of the film was made in five days.' [i.r.: achievement]

[133]The theme nominalisation is achieved in German and Spanish through the nominalisation of the past participles, see for instance *Angestellter* and *empleado* 'employed', in contrast to the derivation with the affix *-ee* to *employee* in English.

[134]This morphological process is sometimes called *transposition* or *syntactic conversion* (cf. Eisenberg, 2000: 281–283) since not only the stem but also inflectional material, i.e. the infinitive endings *-en* in German or -{*a/e/i*}*r* in Spanish, is converted.

[135]For further possible readings, see for instance Dölling (2015: 53–58). I am not going into the details of further event-type distinctions and the so-called Vendler classification (cf. Vendler, 1957). See for an overview Maienborn (2016: 25–34) and the literature cited therein.

c. * El *traducir* de la película está en tu escritorio.
the translate.INF of the film is on your desk
'The translation of the film is on your desk.' [i.r.: object]

(97) a. La *traducción* de la película está demorando bastante.
'The (process of) translation of the film is taking a lot.' [process]

b. La *traducción* de la película se realizó en cinco días.
'The translation of the film was made in five days.' [achievement]

c. La *traducción* de la película está en tu escritorio.
'The translation of the film is on your desk.' [object]

In the literature, some derivations are considered "more verbal" or "closer to their verbal base" than others (cf. Chomsky 1970: 187; Grimshaw 1992; Taylor 1994: 236; Alexiadou 2010a: 497; Bücking 2010: 40; a.o.). So for instance, infinitive nominalisations (cf. (93) and (96)) in German and Spanish are – similar to gerundive nominalisations in English, cf. (98) – "more verbal" than other event nominalisations such as the ones presented in (94) and (97). What is more, it is even possible to detect a different degree of "verbalness" *within* the "more verbal" classes of nominalisations, e.g. in gerundive nominalisations in English and in infinitive nominalisations in Spanish as example (96a) and the following examples from Taylor (1994: 236) show, with (98a) being more verbal than (98b).[136]

(98) a. the enemy('s) *destroying* the city

b. the enemy's *destroying* of the city

This "higher degree of verbalness" is reflected in the syntactic behaviour of the head nouns *traducir* and *destroying*. For instance, in (96a), the head noun can take its internal argument *la película* either with the preposition *de* or without it, with the latter showing the same case assignment as in VPs. The same holds for the English example (98a), the head noun takes the internal argument *the city* directly without preposition, and the external argument can appear with or without the marker *'s*, while in (98b), the preposition *of* is used to combine head and argument and the marker *'s* has to appear.[137] Furthermore, gerundive nominalisations in English and

[136] See Alexiadou (2010b: 518) for a DM approach to both kinds of *-ing*s analysing them as two different kinds of nominalisations, according to the functional head *-ing* realises (i.e. the Little-n head vs. the Aspect head).

[137] See also the case of Classic Arabic in Footnote 33 in Section 4.3.

infinitive nominalisations in Spanish can be modified by adverbs, while other kinds of nominalisations cannot (cf. Chomsky 1970 for further diagnostics).

Now, after considering these three distinct nominalisation types – agent nominalisations, event nominalisations with *-ung* or *-ción*, and infinitive nominalisations – it gets clear that the kind of derivation has a large influence on the argument structure of the derivative and how the arguments are realised morphosyntactically.

Grimshaw (1992: 45–63) argues that the capability of a noun to take (syntactic) arguments correlates with its interpretation (cf. Alexiadou et al. 2007: 497–503 too). She proposes a threefold distinction of event nominalisations:

- complex event nominals (CN),
- simple event nominals (SN), and
- result nominals (RN)

CNs have, according to Grimshaw, an event structure and have thus the same capability as verbs to realise their (syntactic) arguments. Our example (96a) corresponds to what Grimshaw calls CN which "[…] name a process or event".[138] She states further that

> [t]he prediction is, then, that complements to complex event nominals will be obligatory. Of course, obligatory must mean the same for nouns as for verbs: capable in principle of being obligatory but perhaps subject to lexical variation. After all, even direct objects of verbs are sometimes optional. (Grimshaw, 1992: 49)

That is to say, the optionality of verbal arguments is also inherited by the derivative. Moreover, Grimshaw (1992: 49–50) argues that – as it has been shown in example (97) – nouns are highly ambiguous with respect to their interpretation, and that a clear distinction between her three types is only sometimes possible.

In contrast to CNs, SNs and RNs may not take arguments, however they can imply the existence of the arguments (cf. Grimshaw, 1992: 53–54). That is to say, she distinguishes between semantic arguments, which can be implied also when

[138] In this quote, Grimshaw does not explicitly say that a CN *denotes* an event or a process, she only says that it *names* it, but *naming* and *denoting* should be read here as synonymous, since she claims later that CNs and SNs denote events, while RNs do not.

they cannot be realised, and syntactic arguments, which is the actual realisation of an element in a syntagma. Furthermore, RNs – in contrast to CNs and SNs – do not denote events at all, but they "[...] name the output of a process [...]", that is, the result or object reading given for instance in example (97c). The distinction between Grimshaw's CNs and SNs is thus that CNs have obligatory[139] syntactic arguments, while SNs do not have syntactic arguments, though both denote events, i.e. examples (97a) and (97b) would correspond to SNs in case they would not have arguments, according to Grimshaw.

The distinction between CNs, SNs and RNs does not show a clear-cut distinction (cf. Alexiadou, 2009), and has been criticised both from an empirical as well as from a descriptive perspective. See for instance the discussions in Bierwisch (1989: 42–45), Bierwisch (2009: 307–310), Bücking (2012: 194–195), a.o. which refer mostly (but not only) to German data. Concerning the factor "optionality/obligatoriness", Bierwisch (2009: 308) states that

> [i]f, however, argument positions of nouns are generally optional, as must be assumed for independent reasons, the distinction between the absence of a position in A[rgument]S[tructure] and an unrealized optional complement becomes spurious, and the distinction between simple and complex event nouns collapses.

Thus, the distinction between CNs and SNs seems to be based on a circular logic. To be specific: Both, CNs and SNs, denote events. An event nominalisation with arguments is an instance of CN, without arguments an instance of SN; and – closing the circular logic – if a nominal denotes an event and does not have arguments, it is an instance of SN. A further distinctive feature between CNs and SNs concerns their (in-)ability to pluralise. According to Grimshaw, CNs do not pluralise, while SNs (and RNs) do.

The Spanish data – as well as the German data shown by Bierwisch (2009) and Bücking (2012) a.o. – do not confirm the diagnostics provided by Grimshaw (1992). Firstly, as examples (96a), (97a), and (97b) show, nouns denoting events can take arguments, or they can just drop them (cf. (99a), (99b), and (99c)) without yielding ungrammaticality or changing their process/achievement interpretations.

[139] Remember that "obligatory" in Grimshaw's terminology does not need to mean "obligatory" in the sense used in this work. In Grimshaw's terminology, obligatory means rather that the variable for an argument is available, e.g. lambda bound, and that it can be syntactically realised.

(99) a. El *traducir* está demorando bastante.
the translate.INF is prolongating a lot
'The (process of) translation is taking a lot.' [process]

b. Las *traducción* está demorando bastante.
'The (process of) translation is taking a lot.' [process]

c. Las *traducción* se realizó en cinco días.
'The translation was made in five days.' [achievement]

d. Las *traducción* está en tu escritorio.
'The translation is on your desk.' [object]

To reinterpret the noun without arguments as SN would make the line of argumentation vacuous. Furthermore, RNs also have the ability to take arguments (cf. (97c)), reinterpreting these arguments as modifiers (cf. Grimshaw, 1992: 51) does not cope with the data, since they are de facto interpreted with the expected theta-role of the respective argument. Now, with respect to pluralisation, it is indeed true that some nominals with event denotation (e.g. her CN) are less likely to be pluralised (cf. (100a)).

(100) a. * Los *traducir-es* están demorando bastante.
the translate.INF-PL are prolongating a lot
'The (processes of) translation are taking a lot.' [process]

b. Las *traduccion-es* están demorando bastante.
'The (processes of) translation are taking a lot.' [process]

c. Las *traduccion-es* se realizaron en cinco días.
'The translations were made in five days.' [achievement]

d. Las *traduccion-es* están en tu escritorio.
'The translations are on your desk.' [object]

But – albeit rare and normally used in literary contexts (cf. RAE, 2010b: 1967) – it is the case that pluralisations of infinitive nominalisations can be found (cf. example (101)).

(101) [...] pero los andar-es y los hablar-es las delatan como
but the.PL go-PL and the.PL speak-PL them reveal as
irremediablemente condenadas a la pijez [...]
unalterably condemned to the snobbery
'[...] but their walking and speaking reveals their unalterably condemnation to snobbery [...]' (ESCOW 2012)

That is to say, (in-)ability to pluralise cannot be used as a distinctive feature of CNs/SNs/RNs. If this were the case, the event interpretations in (100b), (100c), and (101) would not be available, contrary to what is actually the case. In short, neither the (in-)ability to take arguments, nor the (in-)ability to pluralise are distinguishing diagnostics for a trichotomy as proposed by Grimshaw (1992). As a result, optionality can be assumed more widely in NPs than following the approach in Grimshaw (1992), which would have banned optionality – by virtue of banning arguments per se – of some subclasses of nominals, i.e. SNs and RNs.

The analysis proposed here follows the fundamental idea that the kind of derivation (or the affix – if there is one) determines which arguments are inherited by the derivative (cf. Bierwisch, 2009: 299), and in the case of nouns, with which kind of optionality they are going to be marked. Thus, it does not automatically follow that arguments of event nominalisations show always the same kind of optionality. Here, two kinds of event nominalisations have been introduced: infinitive nominalisations and event nominalisations with the affixes *-ung/-ción*. It has been shown that infinitive nominalisations behave "more verbal" than event nominalisations with *-ung/-ción*. As Bücking (2010) shows in his German data, there is a stronger restriction to drop the internal argument of an infinitive noun if this argument was obligatory for the verbal base. Bücking exemplifies this with the nominalisation of the verb *erreichen* 'to reach' which as a verb has an obligatory internal argument, cf. (102) and (103)[140] (his (3a) and (5)).

(102) Dem EV Landshut droht trotz *des Erreichens*
the Ice Hockey Club Landshut threatens despite the reach.INF
[*der* *Play-offs*$_{\text{TH}}$] in der Deutschen Eishockey-Liga das Aus.
the.GEN play-offs.GEN in the German ice hockey league the out
'Despite the ice hockey club Landshut reached the play-offs in the German League, they are threaten to exit the contest.'

(103) ? Der EV Landshut hat die Play-offs erreicht. *Das*
the Ice Hockey Club Landshut has the play-offs reached the
Erreichen ändert aber nichts an dessen prekärer Lage.
reach.INF changes but nothing at their precarious situation
'The ice hockey club Landshut has reached the play-offs. But, for them to reach the play-offs changes nothing at their precarious situation.'

The acceptability judgements in cases such as (103) are quite subtle. I agree with

[140] Bücking judges (103) to be ungrammatical (*).

Bücking that example (103) is odd, but I differ firstly in the grammaticality judgement and secondly in the explanation of the oddness. In fact, I would judge (103) to be marked (?), rather than ungrammatical (*). In my opinion, there is more than only one constraint which has been violated in (103). Firstly, I agree with Bücking that in infinitive nominalisations the internal argument is not easily omitted if it was an obligatory argument of the verb. However, I will show that under certain circumstances, it is possible to omit it. Secondly, there is a compatibility problem between the infinitive nominalisation of *erreichen* – which should be read as a *process* – and the VP *die prekäre Lage ändern* 'to change the precarious situation' which pushes a *result* reading of the infinitive nominalisation. Thirdly, the verb *erreichen* is telic, but it is not very informative if what has been reached is not mentioned. Moreover, if what is assumed to be communicated is a result (and not a process), then the presence of the internal argument is essential – not necessarily obligatory, but essential.[141] This relation between predicate and argument has been named (degree of) *informativity* by Taylor (1994: 225–233), and it is very similar to the concept of *conceptual autonomy* of Langacker (1969: 286–291).[142] Thus, taking these assumptions into account, it should be possible to achieve a grammatical example of *Erreichen* without internal argument, if it is read as a process, as shown in example (104), with (104a) giving the appropriate context for the omission of the argument in (104b).

(104) a. In diesem Jahr gab es für den FC Bayern viele Probleme zu lösen, darunter: ins Champions League Finale zu kommen und es am Ende zu gewinnen.
'In this year, the FC Bayern had many problems to solve, among others: to reach the final of the Champions League, and winning it.'

b. Das *Erreichen* war sicherlich schwierig, aber das Gewinnen gestaltete
the reach.INF was surely difficult but the win.INF arrange
sich als echte Knochenarbeit.
itself as real bones.work
'To reach the final was surely hard, but to win it turned out to be real back-breaking work.'

[141] Note that this fact is completely contrary to Grimshaw's assumption that RNs cannot have arguments.

[142] See also the distinction drawn by Mittwoch (1982) with respect to argument omission in VPs such as *eat* vs. *eat something*, the former denoting a process and the latter an accomplishment.

As example (104b) shows, a process interpretation improves the grammaticality judgement of *Erreichen* without internal argument. But, if the discourse element denoted by the omitted internal argument is not established, for instance if we did not have (104a), then (104b) would be ungrammatical. Thus, I analyse the internal argument, which has the STTS value *nopt* for the verb, as *opt_est* for the infinitive nominalisation. This adequately predicts that the internal argument can be omitted only if it has been introduced in the discourse.[143]

As Bücking states, the infinitive nominalisation of verbs which are subcategorised for an obligatory internal argument, are not frequent without arguments. In his corpus, he did not find any relevant examples, reinforcing his assumption. However, in the COW corpus I used (DECOW 2015) – which has more than 20 billion tokens – I found very few examples, but they reflect the facts just stated (cf. (105)).

(105) a. Für dessen *Erreichen* müssen wir unsere besten Fähigkeiten und all unsere Energien einsetzen.
for its reach.INF must we our best abilities and all our energies use
'To reach it, we have to use our best skills and all our energy.' (DECOW 2015)

b. Schaffen wir unsere Seligkeit oder wirkt sie Gott, indem er uns das Wollen und das *Erreichen* schenkt?
succeed we our blessedness or effects it God by he us the want.INF and the reach.REACH give
'Does we succeed in our blessednes, or is it caused by God giving us the ability to want (it) and to reach (it)?' (DECOW 2015)

c. Bis zum Erreichen des Stammkapitals einer normalen GmbH, also 25.000 Euro, müssen Rücklagen gebildet werden, die erst nach dem *Erreichen* in Stammkapital umgewandelt werden.
until the reach.INF the share capital a normal PLC i.e. 20.000 euro must reserves built be that not before the reach.INF in share capital convert is
'Financial reserves must be built until the share capital of a normal PLC – 25.000 euros – has been reached. Only after reaching this amount, it can be converted into share capital.' (DECOW 2015)

[143]Interestingly, a demonstrative *dieses* 'this' in (103), i.e. *dieses Erreichen*, seems to improve the acceptability of the sentence as well. I suppose that demonstrative *dieses* intensifies the existence presupposition of an established discourse referent.

The relevance of example (105a) is controversial, since the demonstrative pronoun *dessen* 'his' can be considered as a kind of pre-nominal genitive fulfilling the theta-role of the internal argument (cf. Section 4.6 for an analysis of pre-nominal genitives). Examples (105b) and (105c), however, show that both – the process reading and the established discourse referent – must be guaranteed for the internal argument to be omitted. Admittedly, these cases are not *frequent*, but they are *possible*.

The same holds for Spanish. In example (106), firstly, a context is given in which a discourse referent is introduced (cf. (106a)). Then, the sentence with the omitted argument is given (cf. (106b)). As a contrast, example (107) is given without context, i.e. without introducing first the afterwards omitted argument, making this example ungrammatical.[144]

(106) a. After 50 years of marriage, Irma and Mario are visiting a partner therapy. The problem is related to Mario's difficulties to express his feelings. He tries to verbalise them, but the therapist interrupts him and says:

b. Lo más importante no es el enumerar sino el *expresar*.
the more important not is the enumerate.INF but the express.INF
'The most important is not to enumerate (them), but to express (them).'

(107) * Lo importante en una relación es siempre el *expresar*.
the important in a relationship is always the express.INF
'The most important in a relationship is always to express things.'

[144] I assume that every verb can be used as an infinitive nominalisation free of arguments when only the *process* is being named (cf. (i)). These forms are commonly used in contrast situations in which the process, more specifically the denotation of the eventuality, is being focused, with the arguments being not affected and thus not informative enough to be named (cf. Taylor 1994 with respect to the concept of *informativeness*, and Rausch 2015 with respect to the concept of *affectedness*). I expect these forms to be the result of a lexical rule which "detransitivises" the verb stems, and not necessarily the result of optionality, since the cardinality of arguments but also the eventuality type have to be changed (See Mittwoch 1982 for a correlation between eventuality types and presence/absence of the internal argument, and Sioupi 2014 for the interaction of lexical aspect and eventuality type).

(i) El *alcanzar* no es lo mismo que el *intentar*.
the reach.INF is not the same as the try.INF
'It is not the same thing to reach something than to try something.'

[intended reading]

In short, the omission of internal arguments in infinitive nominalisations is also possible for verb stems which are subcategorised for obligatory internal arguments. But the adequate prediction can be made, only if – also within NPs – a more subtle distinction of optionality is assumed.

Taking into account that only one argument can appear post-nominally with genitive (cf. Section 4.3.1.2), the optionality treatment offered here must have some consequences. One consequence of it is that it should be possible to realise the external argument post-nominally. On the contrary, treating the internal argument as obligatory, it would not be possible to realise the external argument (post-nominally). For instance, Bücking (2010: 43) analyses the external (agent) argument as a modifier, and not as a lambda-bound variable in the argument structure of the deverbal infinitive nominalisation.[145] Again, we are dealing with very subtle grammaticality judgements, but as example (108) shows, it is indeed possible, to omit the internal argument – given the conditions just stated – and realise the agent instead.

(108) Der FC Bayern und Bayer Leverkusen schafften es ins Achtelfinale
the FC Bayern and Bayer Leverkusen made it into.the eighth.final
der Champions League. Das *Erreichen* des FC Bayern war nicht
the Champions League the reach.INF the FC Bayern was not
überraschend, im Vergleich zu dem von Leverkusen.
surprising in comparison to the of Leverkusen
'The FC Bayern and Bayer Leverkusen made it into the last sixteen of the Champions League. That the FC Bayern reached the last sixteen is not surprising, but that Leverkusen did it was.'

Furthermore, in some infinitive nominalisations, the external argument of the verbal base tends to be the preferred reading for the post-nominal genitive. This is the case for some psychological verbs such as *to love*, *to hate*, and *to disappoint* (cf. (109)).

[145] Assuming that the agent argument is not lambda bound does not mean that the theta-role agent is not included in the semantic form anymore. It just implies that the variable satisfying this theta-role is existentially bound (cf. Bücking, 2010: 56) or represents a free variable (cf. Bücking, 2012: 112). See for instace example (111b) taken from Bücking (2010: 56).

(109) das Lieben / Hassen / Enttäuschen der Eltern
the love.INF hate.INF disappoint.INF the parents
'the loving / hating / disappointing of the parents'

In these cases, the experiencer argument plays the role of the (proto)-agent (cf. Dowty 1991: 578, Primus 2009: 266–267) and represents the preferred reading for post-nominal genitives. In German, the interpretation of the post-nominal genitive as stimulus (or proto-patient) is available though, but in Spanish this interpretation is not available at all (cf. Taylor 1994: 202–203 for the English examples). For the stimulus, another preposition has to be chosen in Spanish, namely *a*.[146]

(110) el amar / odiar / decepcionar *a* los padres
the love.INF hate.INF disappoint.INF to the parents
'the loving / hating / disappointing for the parents'

This being said, the proto-agent (or external) argument is not disqualified as a real argument of the noun. Moreover, nominalisations of some verb classes tend to favour the external over the internal argument in the post-nominal position. Nevertheless, the external argument seems to be more likely to be omitted in some cases, and does not present the necessity to be established, in order to be dropped. For this reason, a distinction between both has to be assumed – as it was mentioned at the beginning of this section. I follow the assumption made in Bücking (2010: 43) that the subcategorisation of the verbal base determines the subcategorisation in the nominal derivative. Due to the data just presented, I do not adopt his assumption that the obligatoriness of internal arguments are inherited as such, nor the assumption that external arguments are to be treated as modifiers. But there is indeed a difference between internal and external arguments within NPs (as well as in VPs), and this distinction can be based on optionality types. To be more specific, internal arguments which are obligatory for the verbal base are inherited by the noun as *opt_est*, while external arguments are always inherited as

[146] The preposition *a* in Spanish has many different functions. It is the marker for accusative, dative, but also for directionality (cf. Machicao y Priemer, 2010: 24–37). In addition, it is not only the infinitive nominalisation which makes use of this preposition but also the result/object derivatives of *to love* and *to hate* as (i) shows.

(i) el amor / odio *a* los padres
the love hate to the parents
'the love / hate for the parents'

opt_pure. This more fine-grained optionality distinction seems to be more adequate for the data just presented. In addition, it reflects the common intuition of a general optionality of arguments within NPs. Furthermore, the low preference of cases in which the *opt_est* internal argument is omitted, but the *opt_pure* external arguments is expressed instead, can be explained by virtue of the stronger parsing complexity. This complexity results from different factors: Firstly, the ambiguity, given that two different theta-roles must be assumed; secondly, the omission of a *opt_est* argument; and thirdly, the consequent search for the relevant discourse referent for the omitted *opt_est* argument.

A further problem I see treating the external argument as a modifier concerns its theta-role assignment. In Bücking (2010) and Bücking (2012) the identification of the genitive NP with the agent interpretation is not yielded by satisfying the lambda-bound variable of the noun through Functional Application. Moreover, his analysis makes use of an abduction mechanism. This mechanism is required since the external argument is not lambda bound in the semantic form (cf. (111b) his (18)).[147] For instance in example (111a) (his (15)), the pre-nominal NP in genitive *Georgs* can be interpreted as the agent of the *chirping*. This is the preferred interpretation for this NP. The post-nominal genitive NP *der englischen Nationalhymne* 'of the English national anthem' is interpreted as theme of the *chirping*. (111b) and (111c) (his (19)) give the semantic form and the conceptual structure, respectively, of the phrase in (111a).

(111) a. Georgs$_{\text{AG}}$ Zwitschern der englischen Nationalhymne$_{\text{TH}}$
Georg.GEN chirp.INF the English national anthem
'Georg's chirping of the English national anthem'

b. SF:
$\iota e\ \exists x$ [chirp(e) $\wedge$ agent(e, x) $\wedge$ theme($e, \iota n$[eng.-nat.-anthem(n)]) $\wedge$ R(e,georg)]

c. CS:
ιe [chirp(e) $\wedge$ agent(e,georg) $\wedge$ theme($e, \iota n$[eng.-nat.-anthem(n)])

[147] His abduction mechanism is based on the Two-Level Semantics framework which operates with an interaction of semantic form and conceptual structure (cf. Maienborn, 2003). While the semantic form is determined by the grammar, the conceptual structure is enriched with world knowledge. Both levels interact with each other in order to account for the meaning of expressions (cf. Lang and Maienborn, 2011). Furthermore, Bücking makes use of the Neo-Davidsonian representation of theta-roles.

Since Bücking (2010) analyses the external argument as not lambda bound (cf. the agent variable x in (111b) is already existentially quantified),[148] it is not possible for the constant *Georg* to be incorporated into the semantic form by means of Functional Application. Following Bücking (2010: 56), the semantic form given in (111b) is underspecified in two respects: Firstly, the variable for the agent x is not instantiated; and secondly, the relation R, which is introduced by the genitive is free (cf. Partee, 1997: 466–467). Thus, the conceptual structure in (111c) can be achieved by virtue of the abduction mechanism which states that the utterance meaning yielded (in our case (111c)) must be achieved in the easiest way possible which is compatible with our world knowledge (cf. Maienborn 2003: 490 and Bücking 2010: 55). In (111a) – or more exactly in (111b) – the best candidate for a plausible instantiation is the identification of the agent relation with the underspecified R relation, and hence of the x variable with *Georg* yielding (111c). By means of abduction, many different conceptual structures can be achieved depending on how the world is constructed. For instance, Georg could be not the agent, but the causer of the chirping. That this reading would be possible, but less preferred can be described adequately by the abduction mechanism proposed by Bücking (2010) and Bücking (2012). Two problems of abduction will be exemplified here with (112a) and (113a).[149]

(112) a. das Singen des Kühlschranks$_{\text{AG}}$
the sing.INF the fridge
'the singing of the fridge'

b. SF of *Singen*:
$(\lambda y)\ \lambda e\ \exists x\ [\text{sing}(e) \wedge \text{agent}(e, x) \wedge \text{theme}(e, y)]$

(113) a. das Zuschlagen des Boxers$_{\text{AG/*TH}}$
the hit hard the boxer
'the hard hitting of the boxer'

b. SF of *Zuschlagen*:
$\lambda e\ \exists x\ \exists y\ [\text{hit}(e) \wedge \text{agent}(e, x) \wedge \text{theme}(e, y)]$

[148] Another possibility – instead of the existential quantification of the agent variable – is to leave the variable free. While free variables must be bound at least at the level of conceptual structure – otherwise yielding ungrammaticality, existentially bound variables can remain uninstantiated (cf. Bücking 2012: 112; Lang and Maienborn 2011: 728).

[149] For ease of comparison, I am using the same format as Bücking (2010) – with a Neo-Davidsonian representation – in (112a) and (113a).

In (112a), according to its SF (112b), it is first of all expectable that the genitive NP is incorporated into the semantic form by means of Functional Application. Let us then assume, that the theme argument is optional and omitted. The genitive NP would then have to be introduced by an underspecified relation R, as it was the case in (111b). Now, the CS of (112a) must be computed by means of abduction. We have now the situation of a competition, both the agent relation and the theme relation would be suitable instantiations for R. Moreover, due to the conditions posit by *fridge* and by y, i.e. inanimate, not volitional, etc., the theme relation seems more suitable than the agent relation,[150] yielding the "most economical explanation" for an interpretation of the phrase given with the *fridge* as a theme but not as an agent. That is to say, in this case, the abduction mechanism does not seem to offer the most economical explanation for the most transparent interpretation.

Secondly, in (113a), the verb *zuschlagen* 'to hit hard' is special since its internal argument cannot be syntactically realised, but it is semantically implied that there must be something/someone that was hit hard (cf. (114)).

(114) a. * Sie hat *ihn* wieder zugeschlagen.
she has him again hit hard
'She has hit him hard again.' [intended reading]

b. Sie hat wieder zugeschlagen.
she has again hit hard
'She has hit (someone) hard again.'

Thus, in this case, both agent and theme argument are either existentially quantified or free variables (cf. (113b)). Therefore, a post-nominal genitive NP should be able to be interpreted either as the agent or the theme of the *hitting* by means of abduction. However, the genitive NP can under no circumstances be interpreted as theme. That is to say, in such cases the abductive method seems to overgeneralise.

Summing up, in this section it has been shown that the kind of derivation leading to a nominal influences how the argument structure of the base is inherited by the derivative. However, in contrast to other assumptions (e.g. Grimshaw, 1992) I have shown that arguments of nominal heads can be generally considered optional, with few lexicalised exceptions. Furthermore, in cases of event nominalisations I

[150] The variable should be instantiated by a discourse referent introduced by a linguistic expression, such that the conditions of the variable are met by the referent. This kind of "semantic unification" is called *factoring* (cf. Maienborn, 2003: 490–491).

follow Bücking (2010: 74) in his conclusion that the subcategorisation of the verbal base has to be considered as the primary factor with respect to the inheritance in nominalisations. But in contrast to him, I do not consider the external argument as a modifier but as a semantic and syntactic argument, although it must be taken into consideration that external arguments behave differently than internal ones. This distinction has been accounted for by means of different optionality classes making the classification of optionality – based on Jacobs (1994a) – shown in Section 4.4 fruitful for NPs.

4.6 Pre-nominal genitives: complementation and specification

In the last sections, I have mostly described how post-nominal genitive arguments in NPs can be dealt with. I focused on the post-nominal position, as Spanish and German share the property to realise arguments in this position. In contrast, the pre-nominal position is not available for Spanish nouns in the "standard" variety[151] (cf. (115)).

(115) a. el *tratamiento* de Monica$_{\mathrm{AG/TH}}$
the treatment of.GEN Monica
'Monica's treatment.'

b. * de Monica$_{\mathrm{AG/TH}}$ *tratamiento*
of.GEN Monica treatment
'Monica's treatment.' [intended reading]

In other languages, e.g. Norwegian, the post-nominal position for genitives is not available, i.e. the genitive argument can appear only pre-nominally (cf. Fabricius-Hansen, 1987: 169). However, in German both positions are available for arguments of a nominal head (cf. (116a)–(116c)).[152]

[151] In some varieties of Spanish (cf. example (130b)), the pre-nominal genitive can co-occur with a possessive pronoun. A similar construction with a pre-nominal dative and a possessive pronoun is also found in some German dialects (cf. example (130a)). These two cases are compatible with the analysis offered here.

[152] The same holds for modifiers in genitive. In this work, I am not going to discuss the role of genitive modifiers within NPs.

(116) a. Constantins$_{\text{AG/TH}}$ *Behandlung*
Constantin.GEN treatment
'Constantin's treatment'

b. die *Behandlung* Constantins$_{\text{AG/TH}}$
the treatment Constantin.GEN
'the treatment of Constantin'

c. Annes$_{\text{AG/*TH}}$ *Behandlung* Constantins$_{\text{*AG/TH}}$
Anne.GEN treatment Constantin.GEN
'Anne's treatment of Constantin'

d. * die Constantins *Behandlung*
the Constantin.GEN treatment
'the treatment of Constantin' [intended reading]

e. * *Behandlung* Constantins$_{\text{AG/TH}}$
treatment Constantin.GEN
'a/the treatment of Constantin' [intended reading]

The examples (116a)–(116e) show further that,

1. if only one genitive appears – pre-nominally or post-nominally – it can be interpreted as bearing either of the theta-roles assigned by the nominal head (cf. (116a) and (116b)); but
2. if both arguments appear, the only possible configuration is to have the agent pre-nominally and the theme post-nominally (cf. (116c)); further
3. (116e) shows that count nouns are subcategorised for a specifier which is obligatory in order to be used as an individual term.[153] The contrast between (116a), (116b), and (116d) indicates that the determiner and the pre-nominal genitive constituent are in complementary distribution. That is, only one of both can be realised, but not both at the same time.

The first question to be answered here is: Which structural position does the pre-nominal genitive occupy? Firstly, it is important to recall that,

1. I am assuming an NP hypothesis, that is to say, the noun is treated as the head of the nominal complex and not the determiner;

[153] It is sometimes assumed that mass nouns as well as plural count nouns can be used as terms without article (cf. Krifka, 1991: 400).

2. in headed structures, we assume that there is only one head;[154]
3. the specifier list has been assumed to be a list of only one element;
4. in HPSG, "movement" is, strictly speaking, not available as a mechanism of explanation.

Given the assumptions stated in 1–3; and that the LP-rule for NPs determines that arguments *follow*, but the specifier *precedes* the head (cf. Section 2.5.4), the pre-nominal argument must be assumed in the specifier of the head noun. The question that arises consequently is which position can the pre-nominal genitive take *within the structure of the specifier*. Let us first consider the possibility that the pre-nominal genitive could be either the head of the DP (cf. Jackendoff 1977: 104; Fabricius-Hansen 1987: 175–177; Hartmann and Zimmermann 2003; a.o.) as Figure 4.11 shows, or that it could be the specifier of the DP such as in Figure 4.12 (cf. Haider 1988; Sternefeld 2006a: 209–213; a.o.).

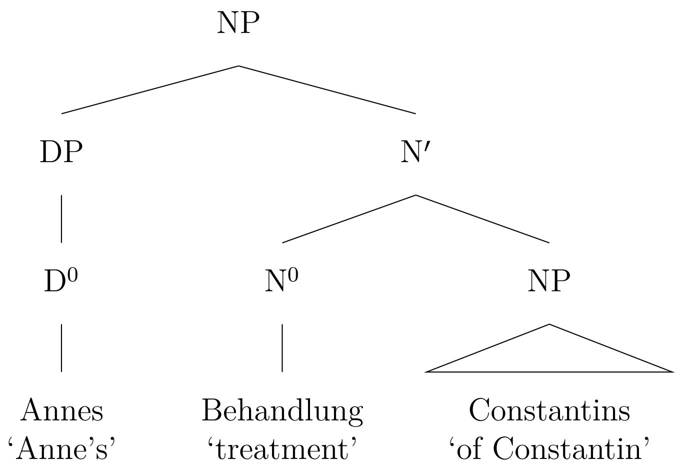

Figure 4.11: Pre-nominal genitive as D^0

Some facts are in favour of the "genitive as head" structure (cf. Figure 4.11): Firstly, the pre-nominal position is guaranteed. Secondly, it would account for the

[154] Hudson (2004) proposes an account in his Word Grammar framework in which *either* the noun *or* the determiner can be the head of the structure. I am not discussing this approach, but I regard it as difficult to implement since it would generate a source of arbitrariness in the grammatical system yielding many spurious ambiguities, and in addition, the central notion of 'head' would become meaningless.

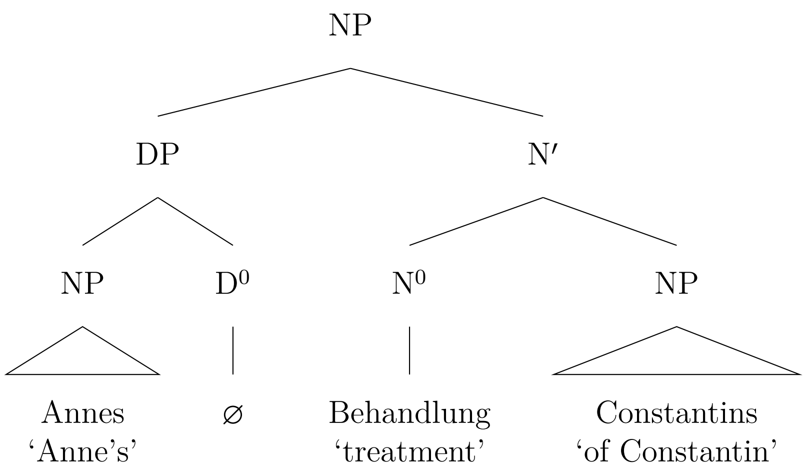

Figure 4.12: Pre-nominal genitive as specifier of specifier

complementarity between genitive and determiner, since only one head position is available. Thirdly, assuming that the genitive is not the head of the DP, an empty head would have to be assumed. Fourthly, the definiteness of the phrase could be – as is expected for determiners – determined by the specifier, in this case the proper noun which is definite (cf. Vater, 1984: 32–33).

In spite of this, the arguments *against* the “genitive as head” and *for* the “genitive as specifier of the specifier” (cf. Figure 4.12) are more compelling and fit better with the data. Firstly, a head position is expected to be occupied by only one lexical element. The examples (116a)–(116c) show only one lexical element in the pre-nominal position: *Constantins* in (116a), *die* in (116b), and *Annes* in (116c).[155] As mentioned before, (116d) shows that a pre-nominal genitive cannot co-occur with a determiner, but there are also examples of complex genitive NPs in pre-nominal position as the following examples taken from Vater (1991) and Müller (1999) show.[156]

[155] Olsen (1991) – in her DP hypothesis based analysis – assumes that the affix *-s* plays the role of the head of the DP. For a more complex structure of the NP with AgrSP and AgrOP in order to derive the different inflection forms of the determiners (e.g. *d-er* ‘the.M’, *d-ie* ‘the.F’, *d-as* ‘the.N’), see Lenerz (1993).

[156] The German and the English pre-nominal genitives cannot be analysed in the same way. This has been shown by Haider (1988: 36–37). He classifies the German pre-nominal genitive NPs as case-marked, while the English counterparts bear a “possessive marking”. He explains the distinction based on the fact that inflection (i.e. case marking) is marked on a head, while the English *possessive* marking occurs on phrases (cf. (i)) (see also Abney 1987: 51–56). For a

(117) a. Paul, [meines Bruders] bester *Freund*
Paul my.GEN brother.GEN best friend
'Paul, my brother's best friend' (Vater, 1991: 21)

b. [meines Patienten] angeblicher *Sohn*
my.GEN patient.GEN alleged son
'my patient's alleged son' (Müller, 1999: 60)

c. [des Onkels] *Anzug*
the.GEN uncle.GEN suit
'the uncle's suit' (Müller, 1999: 60)

Taking the genitive to occupy the D^0 position would raise the question why prenominal genitives in the D^0 position and the head noun do not agree in case. As the following examples in (118) show.

(118) a. Ich habe { den *Anzug* / * des *Anzugs* } anprobiert.
I have the.ACC suit.ACC the.GEN suit.GEN tried
'I have tried the suit.' [intended reading]

b. Ich habe [des Onkels] *Anzug* anprobiert.
I have the.GEN uncle.GEN suit.ACC tried
'I have tried the uncle's suit.'

c. * Ich habe [des Onkels] *Anzugs* anprobiert.
I have the.GEN uncle.GEN suit.GEN tried
'I have tried the uncle's suit.' [intended reading]

Example (118a) shows that the verb *anprobieren* selects an NP in accusative as internal argument. As always, determiner and noun agree in case. The genitive NP (i.e. determiner and noun in genitive) is ungrammatical with this verb. In example (118b), the determiner is replaced by a genitive NP (i.e. *des Onkels*), but the head noun stays in accusative. In this case, the sentence is grammatical, in contrast to example (118c), in which the genitive NP and the head noun agree in case. That is to say, if the genitive NP were to be assumed as the head of the DP in the specifier position of the head noun – i.e. the configuration in Figure 4.11 – then it would be necessary to give up the case agreement between determiner and head noun, an unwanted consequence.

similar behaviour in Norwegian, see Fabricius-Hansen (1987: 168–169).

(i) [the queen of England] *'s* hat

Müller (1999: 58–61) proposes a lexical rule in order to derive a determiner out of a noun. This analysis of pre-nominal genitives has the disadvantage that the genitive noun would be treated as the determiner, i.e. our case-agreement problem would arise. Furthermore, because it is a lexical rule, it could not take a phrase as input, hence not being able to deal with phrases such as the ones given in (117). In some analyses,[157] it has been proposed that pre-nominal genitives in modern German are only possible with proper names similar to the examples in (116), but as the examples in (117) have shown, NPs with a head noun and a determiner are also possible. Thus, it is desirable that our grammatical system can deal with such examples as well.

Another analysis of pre-nominal genitives has been proposed by Olsen (1991) following the DP hypothesis according to Abney (1987). Her analysis suggests – in contrast to Müller (1999) – that the head of the whole structure is *-s*.[158] Olsen's approach is concerned with the pre-nominal genitives of non-eventive nominals. That is to say, she discusses the pre-nominal genitive to head nouns such as *Wagen* 'car', but not to head nouns such as *Verhaftung* 'detention' (cf. Olsen, 1991: 49). But, on the other hand, she also applies her analysis to relational nouns such as *Freundin* '(female) friend', such that assuming – as I am doing it here – that relational nouns in general have arguments, her analysis should be applicable to argumental genitives (of the kind of *Verhaftung*) as well as to non-argumental ones.[159]

According to Olsen (1991)'s approach (cf. Figure 4.13), *-s* represents the lexicalisation of a POSS feature in form of an affix (cf. Abney, 1987: 52). This affix should assign case and a theta-role to the element in its specifier (*Anne* in Figure 4.13). Olsen suggests that the case form is not the "common genitive", but a "possessive

[157] See for instance, Fabricius-Hansen (1987: 169); Hartmann and Zimmermann (2003: 174); Motsch (1999: 323). Olsen (1991: 48) suggests for the non-argumental pre-nominal genitives that they can be only proper names and nouns similar to proper names. Complex pre-nominal genitives are on the contrary allowed by Müller (1999: 59–60), Sternefeld (2006a: 212), a.o.

[158] This option was also considered by Pollard and Sag (1987: 60). They entertain the possibility that the clitic *-s*, and not the head noun, is the head of the phrase. In contrast, Pollard and Sag (1994: 52–53) treat *-s* as an unsaturated determiner which is subcategorised for a non-pronominal NP in order to form a possessive determiner.

[159] Remember that Bücking (2012) made a similar cut between genitives of internal arguments of event nominalisations (his argumental genitives), and all other genitives (his modifier genitives), including in the latter the genitives of external arguments of event nominalisations.

case" which is restricted to the pre-nominal form, only allowed for proper nouns (and similar nouns[160]) also in feminine.[161]

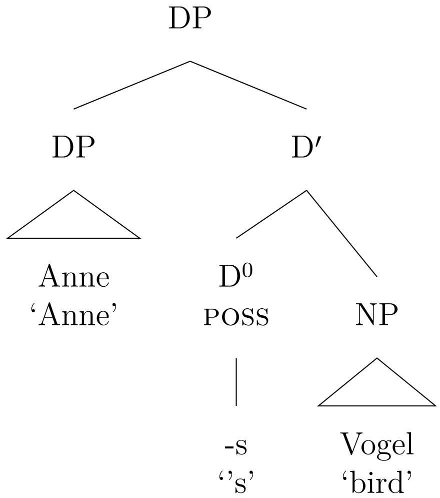

Figure 4.13: Pre-nominal genitive as specifier with 'POSS' as head

If the case assigned to DP in the specifier is not genitive, and it is restricted to the noun adjacent to *-s*, examples such as (117c) are problematic for Olsen's theory, since not only the adjacent noun *Onkels* 'uncle.GEN', but also the determiner *des* 'the.GEN' are in the genitive form – which should actually not be in "genitive" according to Olsen's approach. Thus, the genitive determiner *des* and the head noun *Onkel* – which would be assumed *not* to be in genitive – could not agree in case. Furthermore, contrary to what has been postulated by Olsen, not only the pre-nominal, but also the post-nominal feminine NP can have the affix *-s* (cf. Footnote 161), as the following examples (with sortal nouns and relational nouns) show.

[160] I take nominal heads with a unique referent or which are at least definite to be what Olsen describes as "similar nouns".

[161] In German, the inflectional paradigm of feminine nouns actually does not contain a genitive inflection with *-s*. See for instance, NOM: die Mutter; ACC: die Mutter; DAT: der Mutter; GEN: der Mutter. It is indeed surprising to find the affix *-s* in the paradigm of feminine nouns, but – as the examples suggest – it seems to be a case of paradigm extension which is restricted to feminine nouns that can appear without determiner. This would correlate with Olsen's intuition, that *-s* marking affects only proper nouns and some others which are "similar to them".

(119) a. das Kind im Bauch$_{\text{sort}}$ *Maria-s*
the child in belly Maria-GEN
'the child in Maria's womb' (DECOW 2015)

b. vor *Maria-s* Haus$_{\text{sort}}$
in front of Maria-GEN house
'in front of Maria's house' (DECOW 2015)

c. die Antwort$_{\text{rel}}$ *Maria-s* an Beniamino
the answer Maria-GEN to Beniamino
'Maria's answer to Beniamino' (DECOW 2015)

d. *Maria-s* Mutter$_{\text{rel}}$
Maria-GEN mother
'Maria's mother' (DECOW 2015)

Moreover, as Vater (1991)[162] points out, the affix *-s* is not really obligatory. In fact, nouns such as *Biograph* 'biographer' which belong to other declension classes show other genitive marking (cf. *-en* in (120a)). In addition, a feminine noun such as *Tochter* 'daughter' (cf. Footnote 161) is not marked with the affix *-s* if it is used with a determiner (cf. (120b)). These facts indicate that *-s* as a marker of genitive is expanding its paradigm by marking otherwise unmarked nouns.[163]

(120) a. des *Biograph-en* Hinweis
the.GEN biographer-GEN hint
'the biographer's hint' (Vater, 1991: 23)

b. seiner jüngsten *Tochter-∅* Hingabe
his.GEN youngest daughter devotion
'his youngest daughter's devotion' (Vater, 1991: 23)

In a similar fashion as Olsen (1991), Hartmann and Zimmermann (2003: 176) assume the *-s* to be the head of the DP. But, due to the strong tendency of the pre-nominal genitive to be a proper noun, they analyse – in contrast to Olsen (1991) – the combination of a pre-nominal genitive (normally a proper noun) and *-s* to be the head of the DP (cf. Figure 4.14).

[162] In his analysis, Vater (1991) assumes the same structure as Olsen (1991), but does not agree with the genitive-POSS distinction proposed by Olsen. In addition, it should be pointed out that the analyses in Vater (1984) and Vater (1986) differ widely from his analysis in Vater (1991), assuming in the former an NP analysis and a strictly binary DP structure in the latter.

[163] This reasoning fits very well with the "Principle of morphological realisation" suggested by Olsen (1991: 40).

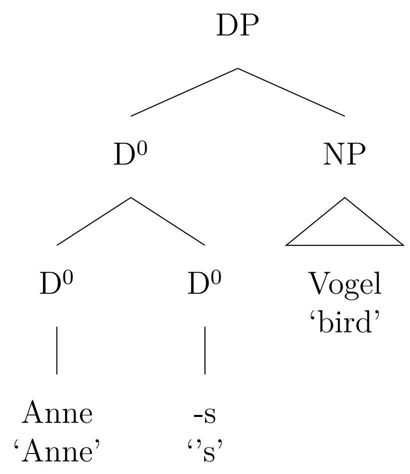

Figure 4.14: Pre-nominal genitive and 'POSS' as head

That is to say, the proper noun must be firstly reanalysed as a determiner *head*[164] and the *-s* affix – also a D-head – is then adjoined to the proper noun. Therefore, they are forced to assume an even more complex reanalysis when determiner and noun appear together pre-nominally, as in example (121) (their (17a)).

(121)	*Des*	*Blauwal-s*	Lebensraum	ist	der	Ozean.
	the.GEN	blue.whale-GEN	habitat	is	the	ocean

'The habitat of the blue whale is the ocean.'

Hence, *des Blauwals* 'of the blue whale' must be assumed to be a D-head consisting of three D-heads: *des* and *Blauwal* being reanalysed as one D-head, and this one being then reanalysed with *-s* as the ultimate determiner of *Lebensraum* 'habitat' (cf. Hartmann and Zimmermann, 2003: 180). Taking this into account, a useful syntactic recursion for pre-nominal genitives seems to be hardly possible in Hartmann and Zimmermann's account, and this is exactly what is intended in their account, since they do not expect complex genitive NPs in pre-nominal position (cf. Footnote 157). But, pre-nominal recursive syntactic structures do indeed exist in German, and in order to analyse structures like the one in (122),[165] it would be necessary to assume the reanalysis of a four-part head: *Peter* + *-s* + *Bruder*

[164] This is similar to the N-movement approach proposed in Longobardi (1994) which assumes that proper names are moved into the D-head position.

[165] Thanks to Manfred Krifka who provided me with this example (Source: `http://www.tautoo.de/galerie.html`).

\+ *-s*.[166] The pre-nominal genitive *Peters* would not be localised in the specifier position of *Bruder*, since it would play the same role as *des* in *des Blauwals* in their example in (121), but as a head immediately adjacent to *Bruder*.

(122) großes Blechloch und Einschüsse auf *Peter-s* *Bruder-s* *Harley*
big tinplate.hole and bullet.hole on Peter-GEN brother-GEN Harley
'big hole on the motorcycle's body and bullet hole on Peter's brother's Harley'

Hartmann and Zimmermann (2003: 182) further make a distinction between the internal structure of English pre-nominal genitives and the German ones. The former builds an entire DP since it represents a maximal projection, the latter builds only a D-head, apparently without further internal structure. Consequently, in their approach, there is no hierarchical syntactic distinction between the four D-heads: *Peter*, *-s*, *Bruder*, *-s* (cf. Figure 4.14). This implies that it is not possible to figure out which of them is actually acting as the head (of the head conglomerate), and every attempt to build a pre-nominal recursive pattern ends in a simple concatenation of heads.

A further aspect to be considered is the definiteness of the phrase which contains the pre-nominal genitive. Fabricius-Hansen (1987: 175–177) and Hartmann and Zimmermann (2003: 180–182) agree in that an NP with a pre-nominal genitive is definite. The following examples in (123), taken from Fabricius-Hansen (1987: 176), should illustrate this fact.

(123) a. Annas Freund
'Anna's friend'

b. der Freund Annas
'the friend of Anna's'

---

[166]The quantity of D-heads can increase as the following examples show

(i) a. der Mann, *dessen Mutters* *Schwesters Kinder* [...] ich kenne
the man whose mother.GEN sister.GEN children I know
'the man whose mother's sister's children I know' (Haider, 1988: 56)

b. Mutters Mutter; Mutters Mutters Mutter; [...]
mother.GEN mother mother.GEN mother.GEN mother
'mother's mother'; 'mother's mother's mother'; [...]
(`http://www.lagis-hessen.de/de/subjects/idrec/sn/gdm/id/965`)

c. ein Freund Annas
'a friend of Anna's'

The NP in (123a), can be paraphrased as in (123b), but not as in (123c). Assuming, that only proper nouns can be pre-nominally, and that the proper noun in genitive occupies the D-head position would explain this fact straightforwardly. But then, the contrast in (124) represents a problem for this assumption.

(124) a. Jeder Gauner hat *Rothschild-s* *Tochter* ausgeraubt.
every trickster has Rothschild-GEN daughter mugged
'Every trickster has mugged Rothschild's daughter.'

b. Jeder Gauner hat *ein-es Bankier-s* *Tochter* ausgeraubt.
every trickster has a-GEN banker-GEN daughter mugged
'Every trickster has mugged a banker's daughter.'

The contrast between *Rothschilds Tochter* in (124a) and *eines Bankiers Tochter* in (124b) shows that proper names make the NP definite. That is, in (124a), we expect Rothschild to have one unique daughter (unique at least in the sense that there is a unique daughter that is relevant in the context), and her existence is presupposed.[167] Furthermore, this unique daughter must have been mugged many times. On the contrary, *eines Bankiers Tochter* in (124b) neither presupposes the existence of this daughter, nor her uniqueness, e.g. there could be one daughter for each trickster. What is more, (124b) shows the characteristic scope ambiguity between the universal quantifier *jeder* 'every' and the existential quantifier *ein* 'a', such that there could be one specific daughter every trickster has mugged, or every trickster has mugged a different daughter (cf. Kobele and Zimmermann, 2012: 270–273). This scope ambiguity is not existent with the definite NP in (124a) which is not interpreted as a quantifier (cf. Krifka, 1992). In Hartmann and Zimmermann (2003: 180), the definiteness of the NP is not dependent on the element on pre-nominal position, but on the genitive/possessive affix *-s* as their representation of the semantics given in (125) (their (21)) illustrate.[168]

(125) Sarahs Verein ('Sarah's club')

[167] See Heim (2011) for more information on definiteness and indefiniteness.

[168] The *R* variable in Hartmann and Zimmermann's representation plays the same role as the one in Bücking (2010) presented in (111b). It is an underspecified variable for the relation introduced by the genitive/possessive head which in the case of modifiers can be instantiated by means of abduction, as proposed by Bücking (2010). See also Partee (1997: 467).

a. $\llbracket \textit{-s} \rrbracket \coloneqq \lambda y\ \lambda \mathrm{P}\ \iota x\ [\mathrm{P}(x) \wedge \mathrm{R}(x, y)]$

b. $\llbracket \textit{Sarahs} \rrbracket \coloneqq \lambda \mathrm{P}\ \iota x\ [\mathrm{P}(x) \wedge \mathrm{R}(x,\text{sarah})]$

c. $\llbracket \textit{Sarahs Verein} \rrbracket \coloneqq \iota x\ [\text{club}(x) \wedge \mathrm{R}(x,\text{sarah})]$

Consequently, in order to account for the distinction between the definite and indefinite pre-nominal genitives presented in (124), and for the resulting (in)definiteness of the whole NP, Hartmann and Zimmermann (2003) would have to assume homophonous *-s* affixes one for each kind of determiner that can appear in pre-nominal position, since their operator is integrated into the logical form of the genitive affix. Furthermore, the different *-s* affixes would have to agree in their definiteness values with the further D-heads.

Due to the facts just shown, I am proposing a structure such as in Figure 4.12 (repeated here as 4.15 for convenience). In order to account for the problems just stated, I am assuming an empty D-head which takes the pre-nominal NP as its specifier.

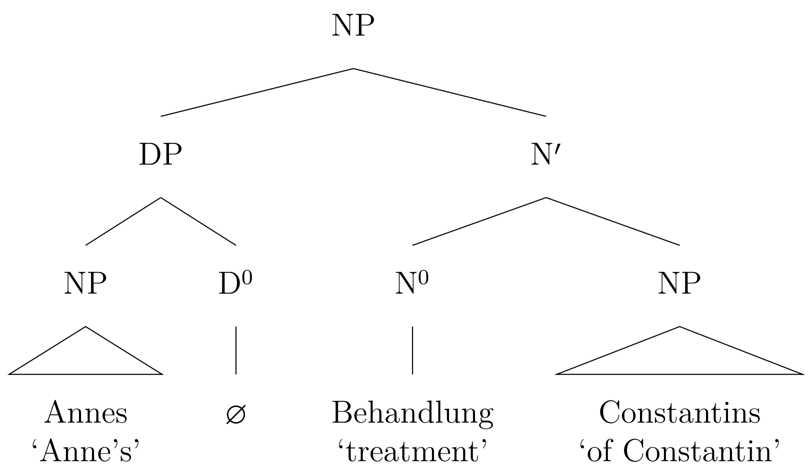

Figure 4.15: Pre-nominal genitive as specifier of specifier

As mentioned by Zimmermann (1990), it is necessary to have good reasons to assume empty heads. In the last decades, there has been an inflationary increase with respect to the assumption of empty heads.[169] In the following, I will justify

[169] The increase of empty functional heads can be observed most notably in cartographic approaches (cf. Cinque and Rizzi, 2010). Discussions about empty categories and their descriptive adequacy can be seen for instance in Zimmermann (1990); Sternefeld and Richter (2012: 274); Müller (2014b: 33–34); Müller (2015a: 19).

my reasons to assume an empty D-head when pre-nominal genitives arise.[170]

Firstly, regarding language as a hierarchically structured system, in which the concatenation of elements should be licensed by the characteristics of the elements themselves and not – if avoidable – by characteristics of an external construction,[171] it is expectable that a determiner must be needed in the structure which I am describing. Furthermore, it is normally assumed that every element in a structure has a function, and that this function often correlates with a position. In our case, the specifier of an NP must be occupied by an element with which the noun stands in a relation of mutual selection as it was explained in Section 3.3.

In contrast to its arguments, the specifier of a head noun is not optional, and agrees with the head noun in the case value. As shown in example (116e), the head noun cannot appear without a determiner.[172] Considered from a semantic perspective, it is commonly assumed that it is the determiner – at least in some languages – which makes an entity (an element of type $\langle e \rangle$) out of a predicate (an element of type $\langle e, t \rangle$) (cf. Barwise and Cooper 1981: 161–166; Heim and Kratzer 1998: 73–75; Chierchia 1998; a.o.). That is to say, the determiner, and in our case the empty determiner, is lexically licensed and required for semantic and syntactic reasons. Furthermore, the empty element proposed here, is in a paradigmatic relation to other elements of the same class, i.e. other determiners, (cf. Zimmermann, 1990: 79–80). That is, I am not proposing any elements for which there is no further evidence in the languages under consideration.

The empty determiner proposed here must fulfil the following requirements:

[170] Abney (1987: 51–60), following the DP hypothesis, suggests also an empty determiner. The possessive phrase *Steven's* in *Steven's treatment* would be generated as a KP (case phrase) – whose head *'s* is – in the complement position of the head noun *treatment*. This KP gets its theta-role from the head noun, but it must move in order to get its case assigned (similar to passive). KP thus moves to the specifier position of the DP and there gets its genitive case from an empty D_{AGR}-head. This idea is based on the assumption that a nominal head cannot assign case to its complement position in English, but this is actually not the case in German (cf. also Adger 2004: 250–275 for a minimalist approach of English pre-nominal genitives).

[171] This reflects the fundamental idea of modern linguistics which can be considered primarily compositional and to some extent head-driven.

[172] The empty determiner I am assuming here is different from the one sometimes assumed in the literature for bare plural count nouns and bare mass nouns (cf. Sternefeld, 2006a: 210), which is – when assumed – analysed rather as ambiguous between a kind-referring interpretation and an indefinite-plural one (cf. Kobele and Zimmermann 2012: 234–235; and Krifka 2003 for the ambiguity between kind and indefiniteness in bare NPs).

1. it agrees with the head noun in case;
2. it requires its specifier to be in genitive;
3. it inherits the definiteness value of its specifier, and projects it to the phrase as its own; and
4. there must be a special relation between the value of SPEC of the empty determiner and the COMPS list of its head noun in such a way as to enable its specifier to be one of the arguments of the head noun (cf. USyn-rule in (133)).

The lexical entry of the empty determiner offered in (126) deals with the facts just stated. It agrees with its head noun in case (cf. $\boxed{1}$), number (cf. $\boxed{3}$), and gender (cf. $\boxed{4}$), without restricting itself to anything except to *agree* with the values of its head noun (cf. (118)). The only agreement value, the determiner is specified for is person (cf. $\boxed{2}$). This is due to the fact that (following Postal (1969)'s idea) I am treating pronouns as determiners which are normally definite and can serve as the specifier of an NP. Furthermore, I assume that the PER feature of nouns is underspecified, and that the PER value is specified by the determiner. In the case of pre-nominal genitives, they are always in 3rd person. The following examples from Spanish and German show that determiners/pronouns specify the PER feature of the NP agreeing with the finite verb – if used as subjects.[173]

(127) a. [$_{NP}$ *Tú* *idiota*] has olvidado recoger-la.
you.2.SG idiot has.2.SG forgotten pick.up-her
'You idiot has forgotten to pick her up.'

b. [$_{NP}$ *Wir* *Linguisten*] können die Welt retten.
we.1.PL linguists can.1.PL the world save
'We linguists can save the world.'

Moreover, the empty determiner selects – as non-empty determiners do – an N with an empty COMPS list through its SPEC attribute. This point will turn out to be an important fact with respect to the combination of the determiner and the noun (cf. USyn-rule in (133)). In addition, the empty determiner is subcategorised also for a specifier. The element in the specifier position must be a noun in genitive with

[173]See Büring (2011: 979) for an overview of alternative analyses, and Olsen (1991: 36–38) for a comment on Postal's analysis.

(126)
$$
\left[\begin{array}{ll}
\textsc{phon} & \langle\ \rangle \\
\textsc{ss}|\textsc{loc} & \left[\begin{array}{ll}
\textsc{cat} & \left[\begin{array}{ll}
\textsc{head} & \left[\begin{array}{ll}
\textsc{case} & \boxed{1} \\
\textsc{per} & \boxed{2}\ \mathit{3} \\
\textsc{num} & \boxed{3} \\
\textsc{gend} & \boxed{4} \\
\textsc{spec} & \left\langle \left[\begin{array}{ll}
\textsc{ss}|\textsc{loc} & \left[\begin{array}{ll}
\textsc{cat} & \left[\begin{array}{ll}
\textsc{head} & \left[\begin{array}{l}
\textsc{case}\ \boxed{1} \\
\mathit{noun}
\end{array}\right] \\
\textsc{val}|\textsc{comps} & \langle\ \rangle
\end{array}\right] \\
\textsc{cont}|\textsc{ind} & \left[\begin{array}{l}
\textsc{per}\ \boxed{2} \\
\textsc{num}\ \boxed{3} \\
\textsc{gend}\ \boxed{4}
\end{array}\right]
\end{array}\right]
\end{array}\right] \right\rangle \\
\mathit{det} &
\end{array}\right] \\
\textsc{val}|\textsc{spr} & \left\langle \left[\begin{array}{ll}
\textsc{ss}|\textsc{loc} & \left[\begin{array}{ll}
\textsc{cat} & \left[\begin{array}{ll}
\textsc{head} & \left[\begin{array}{ll}
\textsc{case} & \mathit{gen} \\
\textsc{q} & \boxed{6} \\
\mathit{noun} &
\end{array}\right] \\
\textsc{val} & \left[\begin{array}{ll}
\textsc{spr} & \langle\ \rangle \\
\textsc{comps} & \langle\ \rangle
\end{array}\right]
\end{array}\right] \\
\textsc{cont}|\textsc{ind}\ \boxed{5} &
\end{array}\right]
\end{array}\right] \right\rangle
\end{array}\right] \\
\textsc{cont} & \left[\begin{array}{ll}
\textsc{ind} & \boxed{5} \\
\textsc{rels} & \texttt{copy}(\boxed{6}) \\
\mathit{mrs} &
\end{array}\right]
\end{array}\right] \\
\mathit{word} &
\end{array}\right]
$$

empty SPR and COMPS lists, i.e. a complete NP. This restriction avoids structures such as (128b) whose specifier has not been realised – although it is subcategorised; and such as (128d) in which the specifier is not realised strictly locally.

(128) a. *Eine-s Lehrer-s Tadel* muss man ernst nehmen.
a-GEN teacher-GEN criticism must one seriously taken
'Criticism of a teacher must be taken seriously.'

b. * *Lehrer-s Tadel* muss man ernst nehmen.
teacher-GEN criticism must one seriously taken
'Criticism of a teacher must be taken seriously.' [intended reading]

c. Gestern begleitete Constantin [$_{\text{NP}}$ *Anne-s Behandlung*].
yesterday attended Constantin Anne-GEN treatment
'Yesterday, Constantin attended Anne's treatment.'

d. * *Anne-s*$_i$ begleitete gestern Constantin [$_{\text{NP}}$ t$_i$ *Behandlung*].
Anne-GEN attended yesterday Constantin treatment
'Yesterday, Constantin attended Anne's treatment.'
[intended reading]

With respect to the semantics of the empty determiner, its IND value is structure-shared with the IND value of its SPR (cf. $\boxed{5}$). The fact that the IND values of the determiner – i.e. $\boxed{5}$ – and the IND values of the head noun – i.e. $\boxed{2}$, $\boxed{3}$, and $\boxed{4}$ – do not have to coincide has been already illustrated with another structure, namely with possessive pronouns, as example (48) from Section 3.3.1, repeated here as (129), illustrates.

(129) a. Er hat *sein-e Taschen* vergessen.
he has his.3.SG.M-3.PL.F bags.3.PL.F forgotten
'He has forgotten his bags.'

b. Ich habe *mein-e Schlüssel* vergessen.
I have my.1.SG-3.PL.M keys.3.PL.M forgotten
'I have forgotten my keys.'

Interestingly, some varieties of German (e.g. Alemannic and Swabian) and of Spanish (e.g. in the Andes and Amazonas regions) reveal a special construction which show a very similar structure to the one generated by the empty determiner (cf. (130)).[174]

[174]The Spanish example comes from `https://amazoniaysucultura.blogspot.de/2009/05/vocabulario-charapa-de-la-selva-su.html`. See Sternefeld (2006a: 221–222) for further German examples and for a similar analysis in MGG.

(130) a. [NP Dem Mann sein Buch] liegt auf dem Boden.
the.DAT man his book lies on the floor
'The book of the man is lying on the floor' (DECOW 2015)

b. de la selva su lengua
of the forest his language
'the language of the jungle'

In these constructions, a possessive pronoun takes the position of the empty determiner and licenses an NP, in German a dative NP and in Spanish a genitive NP, in its specifier position. It is remarkable that the IND value of the pronoun (i.e. *sein* and *su*) and the IND value of the specifier of the pronoun (i.e. *dem Mann* and *de la selva*) have to agree in the same way as in the case of the empty determiners (cf. $\boxed{5}$ in (126)). The only difference between the construction offered in example (130) and the empty determiner in German is the case assignment (i.e. genitive vs. dative). The existence of such an overt determiner with the same (or very similar) properties reinforces the analysis proposed here.

The case of the "definiteness agreement" is especially tricky. The NP with a pre-nominal genitive has at the end the same determiner properties as the pre-nominal genitive, as it was discussed with the examples in (124). The problem is that a quantifier cannot bind more than one variable, therefore if *eines* in *eines Bankiers Tochter* 'a banker's daughter' has already bound the variable of *Bankiers* it cannot bind additionally the variable of *Tochter*. This is probably the reason why in Hartmann and Zimmermann (2003) the *-s* affix has to deliver the ι operator. Another possibility would be to type-shift the pre-nominal genitive to a quantifier looking for a variable to bind (cf. the proposal in Müller 1999: 58–61). Both proposals would present the difficulty that it is the semantic type of the quantifier that would have to be copied, i.e. in *eines Bankiers Tochter* we would need an existential quantifier for daughter, but in *des Bankiers Tochter* we would need a ι operator. The solution I am proposing here uses the advantage of representing quantifiers as EPs as it is customary in MRS. For this solution, I am introducing a head attribute QUANTIFIER (Q) defined for elements of type *noun*. The value of Q is a list of EPs. In a principled way, in nominal phrases, Q must collect the RELS value of the *head of its specifier*, i.e. of D^0. By the combination of an empty determiner as (126) with its pre-nominal genitive, i.e. *eines Bankiers* + ∅, a new relational constraint called `copy` is used. This constraint copies the description in Q, but deletes the values in it. This is important because otherwise the variable position of the quantifier would be already saturated, and this is the reason why structure sharing cannot be used here. The advantage of this approach is that it can be used recursively. I am going to exemplify the procedure using example (122), repeated here as (131), see also Figure 4.16.

(131) Peters Bruders Harley
Peter.GEN brother.GEN Harley
'The Harley of Peter's brother's'

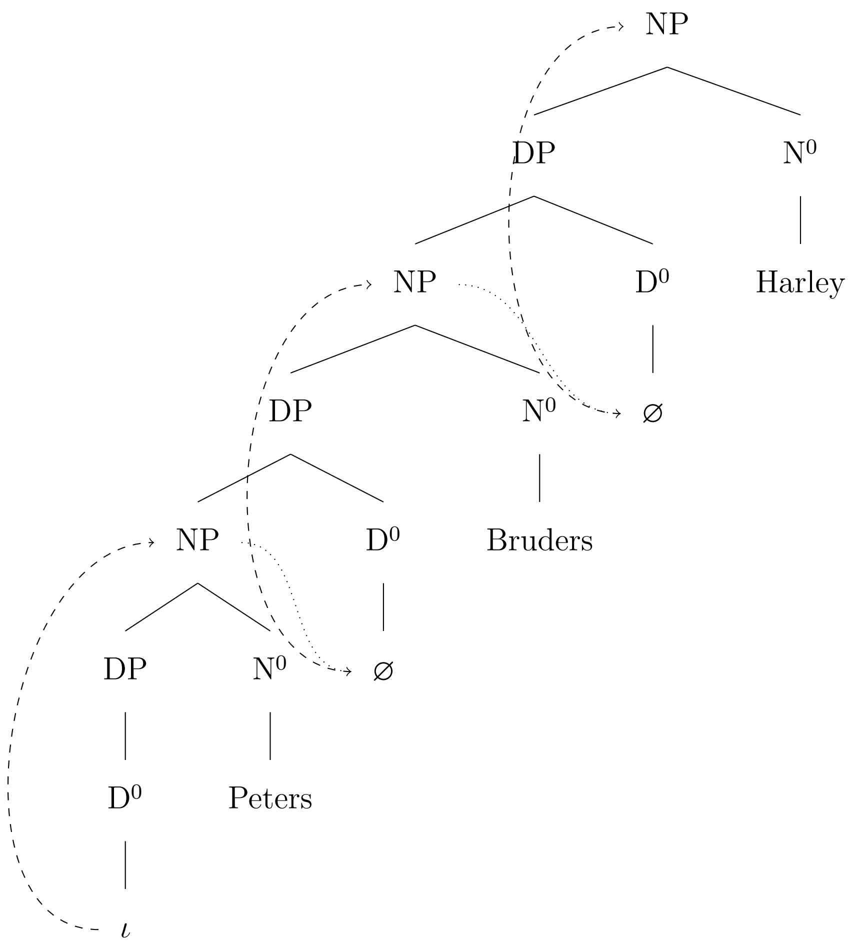

Figure 4.16: Pre-nominal genitives – recursive

Firstly, in the NP *Peters*, the RELS value of the D^0, i.e. ι[175], is projected to the Q attribute of the NP. The empty determiner of the noun *Bruders* copies the value

[175]Following Flickinger et al. (2003: 17), I am assuming that proper nouns must be bound by a determiner. If they are definite, they can be bound by a silent ι operator. In other cases they show an overt determiner, as in the following cases.

of Q and uses it as its own relation, such that *Bruders* is also interpreted as a definite NP. In the next phrase, *Peters Bruders*, the RELS value of the D^0, i.e. $\varnothing$, is projected to the Q attribute of the NP, and so on, such that at the end of the phrase, *Harley* is also interpreted as a definite NP as *Peter* was.

But the question remains, how does an *argument* of the noun ends up as a specifier of the determiner? As already mentioned, HPSG does not make use of movement (cf. Footnote 170), thus, another mechanism has to be used in order to change the position of the argument. Furthermore, as examples (116a) and (116c) above have shown – repeated here as (132) – it is not completely arbitrary in which order the arguments can be ordered. For instance, (132a) indicates, that the external (agent) and the internal (theme) argument can be located in pre-nominal position when no other arguments are in the post-nominal position. On the other hand, (132b) illustrates that only the external argument can be used pre-nominally, when the internal argument is post-nominally, but not the other way around.

(132) a. *Constantin-s*$_{\text{AG/TH}}$ Behandlung
Constantin-GEN treatment
'Constantin's treatment'

b. *Anne-s*$_{\text{AG/*TH}}$ Behandlung *Constantin-s*$_{\text{*AG/TH}}$
Anne-GEN treatment Constantin-GEN
'Anne's treatment of Constantin'

I propose an USyn-rule which lifts the SYNSEM value of the argument in the COMPS list of the noun to the SPR list of its specifier (cf. (133)).[176] It is important that only the SYNSEM value and not the complete argument value is structure-shared, otherwise also the optionality value (i.e. the STTS value) would be shared. But the genitive argument is optional as a complement of the noun, but *not* as a specifier of the specifier of the noun. For concreteness, argument lifting as proposed here is *not* a movement operation. The only thing this USyn-rule is doing is to add more constraints to the specifier of the element which is meant to be the specifier.

(i) a. *die* netten Müllers
the nice Müller.PL

b. *irgendein* Mario
some Mario

[176]Please do not take the name *argument lifting* as it is used here for the "argument lifting" known in semantics, which is a type-shifting operation (see for instance Champollion 2015). Interestingly, the "argument lifting" proposed here, would also result in type shifting in type-driven semantics, but this does not need to bother us at the moment.

(133) Unary Syntactic Rule for argument lifting

$$\begin{bmatrix} \textsc{ss}|\textsc{loc} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{val} & \begin{bmatrix} \textsc{spr} & \boxed{1}\begin{bmatrix}\textsc{ss}|\textsc{loc}|\textsc{cat}|\textsc{val}|\textsc{spr} & \left\langle \text{member}(\boxed{2}) \right\rangle \end{bmatrix} \\ \textsc{comps} & \boxed{3} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \textsc{hd-dtr} & \begin{bmatrix} \textsc{ss}|\textsc{loc} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textit{noun} \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{spr} & \boxed{1} \\ \textsc{comps} & \boxed{2}\ \textit{list}(\textit{str-np}) \oplus \boxed{3}\ \textit{list}(\textit{obl-np}) \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \multicolumn{2}{l}{\textit{word\_or\_phrase}} \end{bmatrix} \\ \multicolumn{2}{l}{\textit{arg\_lift\_ur}} \end{bmatrix}$$

The rule proposed in (133) takes a member of the list of structural arguments, and lifts it to the unary SPR list of the specifier. This separation of the COMPS list into two lists (of structural and oblique arguments) allows examples such as (134a) and avoids to lift oblique arguments such as PPs (cf. (134b)).

(134) a. *Rico-s* Beharren [$_{PP}$ auf gutem Essen]
Rico-GEN insistence on good food
'Rico's insistence on good food'

b. * [$_{PP}$ *auf gutem Essen*] Beharren Rico-s
on good food insistence Rico-GEN

If it were the case that the list of structural arguments contained more than one element – for example an agent and a patient argument by the noun *Behandlung* 'treatment' – then due to the following restrictions posit in different sections of this work, only the expected configurations given in (132) are possible:

- restriction to binary structures,
- ordered saturation of the COMPS list,
- the assumption of a general optionality for arguments of head nouns,
- the USyn-rule for the omission of optional arguments,
- the projection of only the list of oblique arguments in the USyn-rule in (133).

For instance, (132a) with the interpretation of the pre-nominal genitive as theme is available by applying (133) first, thus lifting the internal argument, and then omitting the external argument, by virtue of its STTS value *opt_pure*. As (134a) shows, an oblique PP can be realised, though. If the pre-nominal genitive is going to be interpreted as agent, then either the USyn-rule for optionality applies first to the internal argument, leaving the external argument free to be lifted (as in (132a)), or the head noun is concatenated with its internal argument – obeying the LP-rule for specifier and head – and the external argument is then able to be lifted. The latter option is applicable since the proposed rule takes an object of type *word_or_phrase* as input.

There are two further advantages of this method. Firstly, I have not talked about pre-nominal genitives as modifiers, i.e. the ones which can be interpreted with other theta-roles as the ones provided by the head. In fact, they would not use the USyn-rule in (133) since the modifiers are not arguments to be lifted, but the constraints posited by the empty determiner as proposed in (126) would apply for them in the same way.[177] Secondly, the analysis proposed here allows for recursive structures as the one shown in example (122), since the pre-nominal genitive is allowed to have phrasal status in comparison to the analysis in Hartmann and Zimmermann (2003).

Furthermore, it has been shown that although determiner and pre-nominal genitive have a complementary distribution, it is not the case that the pre-nominal genitive can be treated as a D-head without conflicting with case agreement issues.[178] Thus, the need for empty elements[179] in grammatical description has been proven (again) to be the right answer for an adequate analysis. What is more, although Spanish does not show the possibility to realised pre-nominal genitives in general, certain varieties of Spanish have similar constructions. This distinction can be explained in a lexical way. Standard Spanish lacks the empty determiner, which provides the pre-nominal position for genitives, but some dialects of Spanish exhibit a possessive determiner able to carry a genitive in its specifier.

Last but not least, it has been shown how it could be possible to account for the "definiteness agreement" in complex NPs *copying* the RELS information from D-

[177]The question which must be left open here with respect to genitive modifiers concerns their interpretation. The abduction approach given in Bücking (2010) and further developed in Bücking (2012) seems very promising to me for an HPSG implementation.

[178]Complementary distribution does not force us to analyse elements as belonging to the same category (cf. Stechow and Sternefeld, 1988: 402–405).

[179]For a comment on the empty determiner, see also Löbner (1986).

head position to D-head position, such that not only definite NPs with pre-nominal genitives are licensed by the grammatical system.

This being said, pre-nominal genitives can be considered as a hybrid between arguments and specifiers. They fulfil the theta-role of the head noun and get case-marked by them, but their position is licensed by an empty determiner which inherits their quantifier value, hence determining as well the (in-)definiteness of the whole phrase. That is to say, the combination of a pre-nominal genitive with a head noun is complementation and specification at the same time.

5 Conclusion

Firstly, in Chapter 2, HPSG was explained and compared to other frameworks, not only to similar ones belonging to the family of Unification Grammars, but also to MGG sub-theories developed in the course of time. All the explanatory devices described in this chapter were used to account for the structures of NPs in German and Spanish. The main analyses were conducted in Chapter 4 which dealt with distinct phenomena with respect to the relation between the head noun and its arguments.

The questions which were treated here had to do, on the one hand with system internal aspects of the framework, and on the other hand with descriptive facts of German and Spanish. To be more specific, the former object of inquiry had the underlying question how to extend the HPSG system in order to account for further phenomena. The expansion of the system was achieved by expanding the type hierarchy (e.g. the *opt* type), the inventory of attributes (e.g. DR), of relational constraints (e.g. `copy`), etc. But an expansion of the system is only needed when new phenomena has to be accounted for, and the framework used does not deliver the needed tool for doing it. And, this has to do with the latter object of inquiry: the linguistic data. In the present work, not only new data but also new aspects of old data were presented. These linguistic facts were in need of explanation, resulting in a need for expansion of the system.

In the present work, it has been shown, that although German and Spanish NPs make use of different devices to mark the case of their arguments – the former by means of inflection rules, and the latter by means of a syntactic schema (Head-Marker Schema) – their arguments behave alike (cf. Section 4.2). The structural case which they bear can be predicted in both languages in NPs as well as in VPs by means of the same principle (the CaseP). Furthermore, it has been shown, that the preposition used to mark case in Spanish does not behave as a full preposition, but only as a dummy preposition (cf. Section 4.3.4.1) whose only purpose is to mark the NP, since only a marked NP can be combined with the head noun (cf. Section 4.3.4.3).

In the next section, the optionality issue has been addressed (cf. Section 4.4). The adopted analysis based on the distinction of optionality classes which were here accounted for by means of types in the inheritance hierarchy (cf. Section 4.4.3). Due to these types, the analysis of optionality in the verbal and nominal domain can be analysed more adequately. Without this more fine-grained distinction between optionality classes, it cannot be decided whether some arguments are optional or not. Furthermore, it is possible to get rid of unnecessary lexical entries by postulating conditions to omit arguments, instead of postulating lexical entries with different valences (cf. Section 4.4.2). The way HPSG can deal with optionality speaks in favour of HPSG over other frameworks. It was possible to give an analysis of more idiosyncratic classes of optionality (cf. the case of *geben* 'to give') with the same explanatory devices as for the core cases (cf. *heiraten* 'to marry'). The differences are made visible without banning idiosyncrasy as not analysable (cf. Section 4.4.3).

The discussion of optionality within NPs brings us to a very much discussed topic in the NP literature (cf. Section 4.5). With the proposed optionality distinction, it is possible to account for the intuition that by nominalisations the derivative nouns inherit the argument structure of their base. The fact that only one argument in an NP can be realised in post-nominal position has been accounted for by constraining the post-nominal position. Nevertheless, the possibility to realise a further argument is (at least in German) given in pre-nominal position. Therefore, it would be misleading (or too restrictive) to analyse the external argument as a modifier.

The account given for pre-nominal genitives (cf. Section 4.6) is furthermore able to account for pre-nominally recursive structures and the correct constituent order of arguments, ruling out the possibility to express the internal argument in pre-nominal position and the external argument post-nominally – due to the USyn-rule, the empty determiner, and the general restriction to analyse phrases as binary structures. Moreover, it is predicted that only phrases with structural case can be lifted into the pre-nominal position, and not e.g. PP arguments. In this account for pre-nominal arguments, it also has been shown how the definiteness of the argument is passed on from the last element in specifier position from empty head to empty head until it ends up determining the definiteness of the whole phrase. Hence, with this approach, the intuition can be reflected that pre-nominal genitives behave like specifiers and arguments at the same time. They get their argumental theta-role and the expected structural case from their nominal head, like normal arguments, because they *are* normal arguments, and they determine the (in-)definiteness of the head noun, because they are lifted to the specifier position of the empty determiner.

Surely, further work on NPs must be done. It is for instance necessary to expand the account to pre-nominal genitive modifiers in German. For that, a semantic account – probably based on the abduction mechanism shown in Bücking (2012) – could be implemented in HPSG. What is more, a computer implementation of the analyses offered here has to be done. Parts of this work has been implemented in SpaGram (cf. Müller et al. 2015; Müller et al. 2016) which is the Spanish Grammar fragment within the CoreGram project (cf. Müller, 2015a), but testing theoretical assumptions with grammar implementations can be very enlightening with respect to the predictions (and overgeneralisations) our theoretical systems provide.

References

Abney, Steven P. (1987). *The English Noun Phrase in its Sentential Aspect.* Dissertation, Massachusetts Institute of Technology.

Ackema, Peter (2015). Arguments and adjuncts. In Tibor Kiss and Artemis Alexiadou (Eds.), *Syntax – Theory and Analysis: An International Handbook*, Number 42.1 in Handbooks of Linguistics and Communication Science (HSK), pp. 246–274. Berlin: De Gruyter Mouton.

Adger, David (2004). *Core Syntax: A Minimalist Approach.* Oxford: Oxford University Press.

Ágel, Vilmos (2000). *Valenztheorie.* Tübingen: Narr.

Alexeyenko, Sascha (2011). English '-er' nominals: A case of relative clause structure in morphology. In Gianina Iordăchioaia (Ed.), *The 4th Workshop on Nominalizations (JeNom 4)*, Volume 9 of *SinSpeC: Working Papers of the SFB 732 "Incremental Specification in Context"*, Universität Stuttgart, pp. 1–16. Online Publikationsverbund der Universität Stuttgart (OPUS). `http://elib.uni-stuttgart.de/opus/volltexte/2012/7639/pdf/entire_volume.pdf` [Access: 05/07/2015].

Alexiadou, Artemis (2009). On the role of syntactic locality in morphological processes: The case of (Greek) derived nominals. In Anastasia Giannakidou and Monika Rathert (Eds.), *Quantification, Definiteness, and Nominalization*, pp. 253–280. Oxford: Oxford University Press.

Alexiadou, Artemis (2010a). Nominalizations: A probe into the architecture of grammar. Part I: The nominalization puzzle. *Language and Linguistics Compass 4*(7), 496–511.

Alexiadou, Artemis (2010b). Nominalizations: A probe into the architecture of grammar. Part II: The aspectual properties of nominalizations, and the lexicon vs. syntax debate. *Language and Linguistics Compass 4*(7), 512–523.

Alexiadou, Artemis (2014). *Multiple Determiners and the Structure of DPs.* Amsterdam: Benjamins.

Alexiadou, Artemis, Liliane Haegeman, and Melita Stavrou (2007). *Noun Phrase in the Generative Perspective.* Berlin: Mouton de Gruyter.

Alexiadou, Artemis and Florian Schäfer (2010). On the syntax of episodic vs. dispositional '-er' nominals. In Artemis Alexiadou and Monika Rathert (Eds.), *The Syntax of Nominalizations across Languages and Frameworks*, pp. 9–38. Berlin: De Gruyter Mouton.

Allegranza, Valerio (1998). Determiners as functors: NP structure in Italian. In Sergio Balari and Luca Dini (Eds.), *Romance in HPSG*, pp. 55–107. Stanford: CSLI Publications.

Bach, Emmon (1986). The algebra of events. *Linguistics and Philosophy 1*(9), 5–16.

Badia, Toni (1998). Prepositions in Catalan. In Sergio Balari and Luca Dini (Eds.), *Romance in HPSG*, pp. 109–149. Stanford: CSLI Publications.

Baker, Mark C. (1997). Thematic roles and syntactic structure. In Liliane Haegeman (Ed.), *Elements of Grammar*, pp. 73–137. Dordrecht: Kluwer Academic Publishers.

Barker, Chris (2011). Possessive and relational nouns. In Klaus von Heusinger, Claudia Maienborn, and Paul Portner (Eds.), *Semantics: An International Handbook of Natural Language Meaning*, Number 33.2 in Handbooks of Linguistics and Communication Science (HSK), pp. 1109–1130. Berlin: De Gruyter Mouton.

Barwise, Jon and Robin Cooper (1981). Generalized quantifiers in natural language. *Linguistics and Philosophy 4*(1), 159–219.

Barwise, Jon and John Perry (1983). *Situations and Attitudes*. Cambridge: MIT Press.

Behaghel, Otto (1909). Beziehungen zwischen Umfang und Reihenfolge von Satzgliedern. *Indogermanische Forschungen: Zeitschrift für Indogermanistik und allgemeine Sprachwissenschaft 25*, 110–142.

Bierwisch, Manfred (1989). Event nominalization: Proposals and problems. In Wolfgang Motsch (Ed.), *Wortstruktur und Satzstruktur*, Number 194 in Linguistische Studien: Reihe A. Arbeitsberichte, pp. 1–73. Berlin: Akademie der Wissenschaften der DDR, Zentralinstitut für Sprachwissenschaft.

Bierwisch, Manfred (2006). Thematic roles – Universal, particular, and idiosyncratic aspects. In Ina Bornkessel, Matthias Schlesewsky, Bernard Comrie, and Angela Friederici (Eds.), *Semantic Role Universals and Argument Linking: Theoretical, Typological, and Psycholinguistic Perspectives*, pp. 89–126. Berlin: Mouton de Gruyter.

Bierwisch, Manfred (2009). Nominalization – Lexical and syntactic aspects. In Anastasia Giannakidou and Monika Rathert (Eds.), *Quantification, Definiteness, and Nominalization*, pp. 281–320. Oxford: Oxford University Press.

Bierwisch, Manfred (2011). Semantic underspecification. In Claudia Maienborn, Klaus von Heusinger, and Paul Portner (Eds.), *Semantics: An International Handbook of Natural Language Meaning*, Number 33.1 in Handbooks of Linguistics and Communication Science (HSK), pp. 322–357. Berlin: De Gruyter Mouton.

Bildhauer, Felix (2007). *Representing Information Structure in an HPSG Grammar of Spanish*. Dissertation, Universität Bremen. `http://hpsg.fu-berlin.de/~fbildhau/diss/felix-bildhauer-diss.pdf` [Access: 28/02/2013].

Bildhauer, Felix (2014). Head-Driven Phrase Structure Grammar. In Andrew Carnie, Yosuke Sato, and Dan Siddiqi (Eds.), *The Routledge Handbook of Syntax*, pp. 526–555. Oxford: Routledge.

Blake, Barry (2001). *Case* (2 ed.). Cambridge: Cambridge University Press.

Bloomfield, Leonard (1933). *Language* (1961 ed.). New York: Holt.

Bobaljik, Jonathan and Susan Wurmbrand (2009). Case in GB/Minimalism. In Andrej Malchukov and Andrew Spencer (Eds.), *The Oxford Handbook of Case*, pp. 44–58. Oxford: Oxford University Press.

Borsley, Robert D. (1987a). Subjects and complements in HPSG. Technical Report CSLI-87-107, University College of North Wales, Bangor.

Borsley, Robert D. (1987b). Subjects, complements, and specifiers in HPSG. Manuscript.

Bossong, Georg (1982). Historische Sprachwissenschaft und empirische Universalienforschung. *Romanistisches Jahrbuch 33*, 17–51.

Bouma, Gosse, Robert Malouf, and Ivan A. Sag (2001). Satisfying constraints on extraction and adjunction. *Natural Language and Linguistic Theory 19*(1), 1–65.

Brame, Michael (1982). The head-selector theory of lexical specifications and the nonexistence of coarse categories. *Linguistic Analysis 10*(4), 321–325.

Bresnan, Joan (1978). A realistic Transformational Grammar. In Morris Halle, Joan Bresnan, and George A. Miller (Eds.), *Linguistic Theory and Psychological Reality*, pp. 1–59. Cambridge: MIT Press.

Bresnan, Joan (1982). Control and complementation. *Linguistic Inquiry 13*(3), 343–434.

Bücking, Sebastian (2010). Zur Interpretation adnominaler Genitive bei nominalisierten Infinitiven im Deutschen. *Zeitschrift für Sprachwissenschaft 29*(1), 39–77.

Bücking, Sebastian (2012). *Kompositional flexibel: Partizipanten und Modifikatoren in der Nominaldomäne.* Tübingen: Stauffenburg.

Bücking, Sebastian (2016). Modification. Manuscript. Eberhard Karls Universität Tübingen. Submitted to Mark Arnoff (ed.). Oxford Research Encyclopedia of Linguistics. Oxford: Oxford University Press.

Büring, Daniel (2011). Pronouns. In Klaus von Heusinger, Claudia Maienborn, and Paul Portner (Eds.), *Semantics: An International Handbook of Natural Language Meaning*, Number 33.2 in Handbooks of Linguistics and Communication Science (HSK), pp. 971–996. Berlin: De Gruyter Mouton.

Büring, Daniel and Katharina Hartmann (1991). Regelhaft und regellos: Zum Verhältnis von Syntax und Lexikon. Technical Report 10, Heinrich Heine Universität Düsseldorf. Arbeiten des Sonderforschungsbereichs 282. Theorie des Lexikons.

Calcagno, Mike and Carl Jesse Pollard (1995). Lexical rules in HPSG: What are they? Manuscript. `http://ling.osu.edu/~dm/papers/calcagno-pollard.html` [Access: 01/05/2016].

Champollion, Lucas (2015). The interaction of compositional semantics and event semantics. *Linguistics and Philosophy 38*(1), 31–66.

Chierchia, Gennaro (1984). *Topics in the Syntax and Semantics of Infinitives and Gerunds.* Dissertation, University of Massachusetts, Amherst.

Chierchia, Gennaro (1998). Reference to kinds across languages. *Natural Language Semantics 6*, 339–405.

Chomsky, Noam (1964). *Current Issues in Linguistic Theory.* Number 38 in Janua Linguarum [Series minor]. The Hague: Mouton & Co.

Chomsky, Noam (1965). *Aspects of the Theory of Syntax.* Cambridge: MIT Press.

Chomsky, Noam (1970). Remarks on nominalization. In Roderick A. Jacobs and Peter S. Rosenbaum (Eds.), *Readings in English Transformational Grammar*, pp. 184–221. Waltham: Ginn & Company.

Chomsky, Noam (1981). *Lectures on Government and Binding: The Pisa Lectures.* Studies in Generative Grammar. Dordrecht: Foris Publications.

Chomsky, Noam (1986). *Barriers* (1990, 3rd ed.). Cambridge: MIT Press.

Chomsky, Noam (1995). *The Minimalist Program* (1997, 3rd ed.). Cambridge: MIT Press.

Chomsky, Noam and Morris Halle (1968). *The Sound Pattern of English.* New York: Harper & Row.

Chomsky, Noam and Howard Lasnik (1993). The theory of principles and parameters. In Joachim Jacobs, Arnim von Stechow, Wolfgang Sternefeld, and Theo Vennemann (Eds.), *Syntax: Ein internationales Handbuch zeitgenössischer Forschung*, Number 9.1 in Handbooks of Linguistics and Communication Science (HSK), pp. 506–569. Berlin: Walter de Gruyter.

Chung, Sandra and William A. Ladusaw (2004). *Restriction and Saturation.* Cambridge: MIT Press.

Cinque, Guglielmo (1999). *Adverbs and Functional Heads: A Cross-Linguistic Perspective.* Oxford: Oxford University Press.

Cinque, Guglielmo (2005). Deriving Greenberg's Universal 20 and its exceptions. *Linguistic Inquiry 36*(3), 315–332.

Cinque, Guglielmo and Luigi Rizzi (2010). The cartography of syntactic structures. In Bernd Heine and Heiko Narrog (Eds.), *The Oxford Handbook of Linguistic Analysis*, pp. 51–65. Oxford: Oxford University Press.

Company Company, Concepción (2006). El objeto indirecto. In Concepción Company Company (Ed.), *Sintaxis histórica de la lengua española. Primera parte: La frase verbal*, Volume 1, pp. 479–572. Mexico: Universidad Nacional Autónoma de México. Fondo de Cultura Económica.

Comrie, Bernard (1976). The syntax of action nominals: A cross-language study. *Lingua 40*(2/3), 177–201.

Comrie, Bernard, Martin Haspelmath, and Balthasar Bickel (2015). Leipzig glossing rules. Manuscript. `http://www.eva.mpg.de/lingua/resources/glossing-rules.php` [Access: 27/01/2016].

Cook, Philippa (2014). Between complex predicates and regular phrases: German collocational clusters. In Stefan Müller (Ed.), *The 21st International Conference on Head-Driven Phrase Structure Grammar (HPSG 2014)*, University at Buffalo, pp. 48–62. CSLI Publications. `http://csli-publications.stanford.edu/HPSG/2014` [Access: 29/07/2015].

Copestake, Ann, Daniel P. Flickinger, Carl Pollard, and Ivan A. Sag (2005). Minimal recursion semantics: An introduction. *Research on Language and Computation 3*(4), 281–332. `http://lingo.stanford.edu/sag/papers/copestake.pdf` [Access: 18/01/2015].

Culicover, Peter and Ray Jackendoff (2005). *Simpler Syntax.* Oxford: Oxford University Press.

Davidson, Donald (1967). The logical form of action sentences. In Nicholas Resher (Ed.), *The Logic of Decision and Action*, pp. 81–95. Pittsburgh: University of Pittsburgh Press.

Davis, Anthony and Jean-Pierre Koenig (2000). Linking as constraints on word classes in a hierarchical lexicon. *Language 76*(1), 56–91.

De Kuthy, Kordula and W. Detmar Meurers (2003). Dealing with optional complements in HPSG-based grammar implementations. In Stefan Müller (Ed.), *The 10th International Conference on Head-Driven Phrase Structure Grammar (HPSG 2003)*, Michigan State University, pp. 88–96. CSLI Publications. `http://web.stanford.edu/group/cslipublications/cslipublications/HPSG/2010/` [Access: 30.06.2015].

Demonte, Violeta (1987). C-command, prepositions, and predication. *Linguistic Inquiry 18*(1), 147–157.

Di Sciullo, Anna Maria and Edwin Williams (1988). *On the Definition of Word*. Cambridge: MIT Press.

Dölling, Johannes (2015). Sortale Variation der Bedeutung bei 'ung'-Nominalisierungen. In Christian Fortmann, Anja Lübbe, and Irene Rapp (Eds.), *Situationsargumente im Nominalbereich*, pp. 49–92. Berlin: De Gruyter Mouton.

Dowty, David (1991). Thematic proto-roles and argument selection. *Language 67*(3), 547–619.

Ehrich, Veronika and Irene Rapp (2000). Sortale Bedeutung und Argumentstruktur: 'ung'-Nominalisierungen im Deutschen. *Zeitschrift für Sprachwissenschaft 19*(2), 245–303.

Eisenberg, Peter (2000). *Grundriss der deutschen Grammatik: Das Wort*, Volume 1. Stuttgart: Metzler.

Eisenberg, Peter (2013). *Grundriss der deutschen Grammatik: Der Satz* (4th ed.), Volume 2. Stuttgart: Metzler.

Evans, Nicholas and Stephen C. Levinson (2009). The myth of language universals: Language diversity and its importance for cognitive science. *Behavioral and Brain Sciences 32*, 429–492.

Fabricius-Hansen, Cathrine (1987). Über den adnominalen Genitiv im Deutschen und Norwegischen. In Lutz Götze (Ed.), *Schriften zur Deutsch-Didaktik: Deutsch als Fremdsprache. Situation eines Faches*, pp. 166–183. Bonn: Dürr.

Featherston, Sam (2001). *Empty Categories in Sentence Processing*. Amsterdam: John Benjamins.

Flickinger, Daniel P. (1987). *Lexical Rules in the Hierarchical Lexicon.* Dissertation, Stanford University.

Flickinger, Daniel P. (2000). On building a more efficient grammar by exploiting types. *Natural Language Engineering 6*(1), 15–28.

Flickinger, Daniel P., Emily M. Bender, and Stephan Oepen (2003). MRS in the LinGO Grammar Matrix: A practical user's guide. `http://faculty.washington.edu/ebender/papers/` [Access: 18/01/2015].

Flickinger, Daniel P., Carl Pollard, and Thomas Wasow (1985). Structure-sharing in lexical representation. In William C. Mann (Ed.), *Proceedings of the Twenty-Third Annual Meeting of the Association for Computational Linguistics*, Chicago, pp. 262–267.

Fodor, Jerry A. and Janet D. Fodor (1980). Functional structure, quantifiers, and meaning postulates. *Linguistic Inquiry 11*(4), 759–770.

Fortmann, Christian (1996). *Konstituentenbewegung in der DP-Struktur: Zur funktionalen Analyse der Nominalphrase im Deutschen.* Tübingen: Niemeyer.

Fries, Norbert (1988a). *Präpositionen und Präpositionalphrasen im Deutschen und im Neugriechischen: Aspekte einer kontrastiven Analyse Deutsch – Neugriechisch.* Tübingen: Max Niemeyer.

Fries, Norbert (1988b). Über das Null-Topik im Deutschen. *Sprache und Pragmatik 3*, 19–49.

Fries, Norbert (1991). Präpositionen und Präpositionalphrasen im Deutschen, im Altgriechischen und im Neugriechischen. In Susan Olsen and Gisbert Fanselow (Eds.), *'DET, COMP und INFL': Zur Syntax funktionaler Kategorien und grammatischer Funktionen*, pp. 73–82. Tübingen: Max Niemeyer.

Fries, Norbert (1997). *Die hierarchische Organisation grammatischer Kategorien.* Number 7 in Sprachtheorie und germanistische Linguistik. Debrecen: Institut für Germanistik an der Lajos-Kossuth-Universität.

Fries, Norbert (2008). Zur bleibenden Schwierigkeit des Deutschen und seiner Geschlechter. In Wilfried Kürschner and Manfred Ringmacher (Eds.), *Akten des III. Ost-West-Kolloquium*, Tübingen. Gunter Narr.

Fries, Norbert and Antonio Machicao y Priemer (2016a). Bay Area Grammars. In Helmut Glück and Michael Rödel (Eds.), *Metzler Lexikon Sprache* (5^{th} ed.)., pp. 87. Stuttgart: Metzler.

Fries, Norbert and Antonio Machicao y Priemer (2016b). Kopf. In Helmut Glück and Michael Rödel (Eds.), *Metzler Lexikon Sprache* (5^{th} ed.)., pp. 371–372. Stuttgart: Metzler.

Fries, Norbert and Antonio Machicao y Priemer (2016). X-Bar-Theorie. In Helmut Glück and Michael Rödel (Eds.), *Metzler Lexikon Sprache* (5th ed.)., pp. 779–780. Weimar: Metzler.

Fábregas, Antonio (2010). A syntactic account of affix rivalry in Spanish nominalizations. In Artemis Alexiadou and Monika Rathert (Eds.), *The Syntax of Nominalizations across Languages and Frameworks*, pp. 67–91. Berlin: De Gruyter Mouton.

Gazdar, Gerald, Ewan Klein, Geoffrey K. Pullum, and Ivan A. Sag (1985). *Generalized Phrase Structure Grammar*. Cambridge: Harvard University Press.

Georgi, Doreen and Gereon Müller (2010). Noun-phrase structure by reprojection. *Syntax 13*(1), 1–36.

Gerstner-Link, Claudia and Manfred Krifka (1993). Genericity. In Joachim Jacobs, Arnim von Stechow, Wolfgang Sternefeld, and Theo Vennemann (Eds.), *Syntax: Ein internationales Handbuch zeitgenössischer Forschung*, Number 9.1 in Handbooks of Linguistics and Communication Science (HSK), pp. 966–978. Berlin: Walter de Gruyter.

Green, John N. (1988). Spanish. In Martin Harris and Nigel Vincent (Eds.), *The Romance Languages*, pp. 79–130. London: Croom Helm.

Greenberg, Joseph H. (1963). Some universals of grammar with particular reference to the order of meaningful elements. In Joseph H. Greenberg (Ed.), *Universals of Language*, pp. 58–90. Cambridge: MIT Press. Conference held at Dobbs Ferry, New York, April 13–15, 1961, and sponsored by the Linguistic and Psychology Committee of the Social Science Research Council.

Grewendorf, Günther (1995). German. In Joachim Jacobs, Arnim von Stechow, Wolfgang Sternefeld, and Theo Vennemann (Eds.), *Syntax: Ein internationales Handbuch zeitgenössischer Forschung*, Number 9.2 in Handbooks of Linguistics and Communication Science (HSK), pp. 1288–1319. Berlin: Walter de Gruyter.

Grimshaw, Jane B. (1992). *Argument Structure*. Cambridge: MIT Press.

Haegeman, Liliane (1994). *Introduction to Government and Binding Theory* (2nd ed.). Oxford: Blackwell.

Haegeman, Liliane and Barbara Ürögdi (2010a). Operator movement, referentiality and intervention. *Theoretical Linguistics 36*(2/3), 233–246.

Haegeman, Liliane and Barbara Ürögdi (2010b). Referential CPs and DPs: An operator movement account. *Theoretical Linguistics 36*(2/3), 111–152.

Haider, Hubert (1985). The case of German. In Jindřich Toman (Ed.), *Studies in German Grammar*, pp. 65–101. Dordrecht: Foris Publications.

Haider, Hubert (1986). Fehlende Argumente: Vom Passiv zu kohärenten Infinitiven. *Linguistische Berichte 101*, 3–33.

Haider, Hubert (1988). Die Struktur der deutschen Nominalphrase. *Zeitschrift für Sprachwissenschaft 7*(1), 32–59.

Hartmann, Katharina and Malte Zimmermann (2003). Syntactic and semantic adnominal genitive. In Claudia Maienborn (Ed.), *(A-)symmetrien – (A-)symmetries: Beiträge zu Ehren von Ewald Lang*, pp. 171–202. Tübingen: Stauffenburg.

Haspelmath, Martin (2009). Terminology of case. In Andrej Malchukov and Andrew Spencer (Eds.), *The Oxford Handbook of Case*, pp. 505–517. Oxford: Oxford University Press.

Haspelmath, Martin (2010). Framework-free grammatical theory. In Bernd Heine and Heiko Narrog (Eds.), *The Oxford Handbook of Linguistic Analysis*, pp. 341–365. Oxford: Oxford University Press.

Heim, Irene (1988). *The Semantics of Definite and Indefinite Noun Phrases.* Outstanding Dissertations on Linguistics. New York: Garland. [Published Dissertation from 1982 at the University of Massachusetts, Amherst].

Heim, Irene (2011). Definiteness and indefiniteness. In Klaus von Heusinger, Claudia Maienborn, and Paul Portner (Eds.), *Semantics: An International Handbook of Natural Language Meaning*, Number 33.2 in Handbooks of Linguistics and Communication Science (HSK), pp. 996–1025. Berlin: De Gruyter Mouton.

Heim, Irene and Angelika Kratzer (1998). *Semantics in Generative Grammar* (2000, 2nd ed.). Oxford: Blackwell.

Heinz, Wolfgang and Johannes Matiasek (1994). Argument structure and case assignment in German. In John A. Nerbonne, Klaus Netter, and Carl Pollard (Eds.), *German in Head-Driven Phrase Structure Grammar*, pp. 199–236. Stanford: Center for the Study of Language and Information.

Higginbotham, James (1985). On semantics. *Linguistic Inquiry 16*(4), 547–593.

Hirschmann, Hagen (2015). *Modifikatoren im Deutschen: Ihre Klassifizierung und varietätenspezifische Verwendung.* Tübingen: Stauffenburg.

Hole, Daniel (2015). Arguments and adjuncts. In Tibor Kiss and Artemis Alexiadou (Eds.), *Syntax – Theory and Analysis: An International Handbook*, Number 42.2 in Handbooks of Linguistics and Communication Science (HSK), pp. 1284–1320. Berlin: De Gruyter Mouton.

Huddleston, Rodney D. (2006). Nouns and noun phrases. In Rodney D. Huddleston (Ed.), *English Grammar: An Outline* (14th ed.)., pp. 84–107. Cambridge: Cambridge University Press.

Hudson, Richard (2004). Are determiners heads? *Functions of Language 11*(1), 7–42. Special Issue: Grounding and Headedness in the Noun Phrase.

Jackendoff, Ray (1977). *X-Bar Syntax: A Study of Phrase Structure* (1991, 5th ed.). Linguistic Inquiry Monographs. Cambridge: MIT Press.

Jackendoff, Ray (1997). *The Architecture of Language Faculty.* Cambridge: MIT Press.

Jackendoff, Ray (2002). *Foundations of Language Brain, Meaning, Grammar, Evolution.* Oxford: Oxford University Press.

Jackendoff, Ray (2011). The Parallel Architecture and its place in cognitive science. In Andreas Nolda and Oliver Teuber (Eds.), *Syntax and Morphology Multi-Dimensional*, pp. 17–44. Berlin: De Gruyter.

Jacobs, Joachim (1994a). Das lexikalische Fundament der Unterscheidung von fakultativen und obligatorischen Ergänzungen. *Zeitschrift für germanistische Linguistik 22*(3), 284–319.

Jacobs, Joachim (1994b). *Kontra Valenz.* Trier: Wissenschaftlicher Verlag Trier.

Jacobs, Joachim (2003). Die Problematik der Valenzebenen. In Vilmos Ágel, Ludwig M. Eichinger, Hans-Werner Eroms, Peter Hellwig, Jürgen Heringer Hans, and Henning Lobin (Eds.), *Dependenz und Valenz: Ein internationales Handbuch der zeitgenössischen Forschung*, Number 25.1 in Handbooks of Linguistics and Communication Science (HSK), pp. 378–399. Berlin: Walter de Gruyter.

Jacobs, Joachim (2009). Valenzbindung oder Konstruktionsbindung? Eine Grundfrage der Grammatiktheorie. *Zeitschrift für germanistische Linguistik 37*(3), 490–513.

Jiménez Juliá, Tomás and Irene Doval Reixa (2014). Notes on prepositional systematicity in German and Spanish. In Antonio Machicao y Priemer, Andreas Nolda, and Athina Sioupi (Eds.), *Zwischen Kern und Peripherie: Untersuchungen zu Randbereichen in Sprache und Grammatik*, pp. 237–268. Berlin: De Gruyter.

Katz, Jerrold J. and Paul M. Postal (1964). *An Integrated Theory of Linguistic Descriptions.* Cambridge: MIT Press.

Kayne, Richard (1994). *The Antisymmetry of Syntax.* Cambridge: MIT Press.

Keenan, Edward (1976). Towards a universal definition of 'subject'. In Charles Li (Ed.), *Subject and Topic*, pp. 303–333. New York: Academic Press.

Keenan, Edward and Bernard Comrie (1977). Noun phrase accessibility and Universal Grammar. *Linguistic Inquiry 8*(1), 63–99.

Kertész, András, Edith Moravcsik, and Csilla Rákosi (Eds.) (2019). *Current Approaches to Syntax – A Comparative Handbook.* Number 3 in Comparative Handbooks of Linguistics. Berlin: De Gruyter Mouton.

King, Paul J. (1999). Towards truth in Head-Driven Phrase Structure Grammar. In Valia Kordoni (Ed.), *Tübingen Studies in Head-Driven Phrase Structure Grammar*, Number 132 in Arbeitsberichte des SFB 340: Sprachtheoretische Grundlagen für die Computerlinguistik, pp. 301–352. Tübingen: Eberhard-Karls-Universität Tübingen.

Kirchner, Arne R. (1999). *Eine kopfgesteuerte Phrasenstrukturgrammatik für spanische Nominalphrasen.* Dissertation, Georg-August-Universität zu Göttingen. `http://webdoc.sub.gwdg.de/diss/2000/kirchner/` [Access: 19/04/2013].

Kiss, Tibor (1995). *Merkmale und Repräsentationen: Eine Einführung in die deklarative Grammatikanalyse.* Opladen: Westdeutscher Verlag.

Klenk, Ursula (2003). *Generative Syntax.* Tübingen: Narr.

Kobele, Gregory and Malte Zimmermann (2012). Quantification in German. In Edward Keenan and Denis Paperno (Eds.), *Handbook of Quantifiers in Natural Language*, pp. 227–283. Berlin: Springer.

Koenig, Jean-Pierre (1999). *Lexical Relations.* Stanford: CSLI Publications.

Koenig, Jean-Pierre (2016). Event semantics. In Nick Riemer (Ed.), *The Routledge Handbook of Semantics*, pp. 387–402. Oxford: Routledge.

Kratzer, Angelika (1996). Severing the external argument from its verb. In Johan Rooryck and Laurie Zaring (Eds.), *Phrase Structure and the Lexicon*, pp. 109–137. Dordrecht: Kluwer Academic Publishers.

Krifka, Manfred (1989a). Nominal reference, temporal constitution and quantification in event semantics. In Renate Bartsch, Johan van Benthem, and Peter von Emde Boas (Eds.), *Semantics and Contextual Expression*, pp. 75–115. Dordrecht: Foris Publications.

Krifka, Manfred (1989b). *Nominalreferenz und Zeitkonstitution: Zur Semantik von Massentermen, Pluraltermen und Aspektklassen.* München: Wilhelm Fink.

Krifka, Manfred (1991). Massennomina. In Arnim von Stechow and Dieter Wunderlich (Eds.), *Semantik: Ein internationales Handbuch zeitgenössischer Forschung*, Number 6.1 in Handbooks of Linguistics and Communication Science (HSK), pp. 399–417. Berlin: Walter de Gruyter.

Krifka, Manfred (1992). Definite NPs aren't quantifiers. *Linguistic Inquiry 23*(1), 156–163.

Krifka, Manfred (1995a). Common nouns: A contrastive analysis of Chinese and English. In Gregory N. Carlson and Francis J. Pelletier (Eds.), *The Generic Book*, pp. 398–411. Chicago: University of Chicago Press.

Krifka, Manfred (1995b). Focus and the interpretation of generic sentences. In Gregory N. Carlson and Francis J. Pelletier (Eds.), *The Generic Book*, pp. 238–264. Chicago: University of Chicago Press.

Krifka, Manfred (2003). Bare NPs: Kind-referring, indefinites, both, or neither? In Olivier Bonami and Patricia Cabredo Hofherr (Eds.), *Empirical Issues in Syntax and Semantics. Proceedings of the 5th Colloque de Syntaxe et Sémantique à Paris*, Volume 5, Université Paris 7, pp. 111–132. `http://www.cssp.cnrs.fr/eiss5/` [Access: 26/04/2013].

Krifka, Manfred (2007). Basic notions of information structure. In Caroline Féry, Gisbert Fanselow, and Manfred Krifka (Eds.), *Working Papers of the SFB 632: The notions of information structure. Interdisciplinary Studies on Information Structure (ISIS)*, Volume 6, pp. 13–56. Potsdam: Universitätsverlag Potsdam.

Krifka, Manfred (2009). Case syncretism in German feminines: Typological, functional and structural aspects. In Patrick Steinkrüger and Manfred Krifka (Eds.), *On Inflection*, pp. 141–172. Berlin: Mouton de Gruyter.

Krifka, Manfred (2014). Embedding illocutionary acts. In Thomas Roeper and Margaret Speas (Eds.), *Recursion: Complexity in Cognition*, pp. 125–155. Berlin: Springer.

Krifka, Manfred and Fereshteh Modarresi (2016). Number neutrality and anaphoric update of pseudo-incorporated nominals in Persian (and weak definites in English). In Mary Moroney, Carol-Rose Little, Jacob Collard, and Dan Burgdorf (Eds.), *26th Semantics and Linguistic Theory (SALT 26)*, University of Texas at Austin. Cornell University. `http://www.zas.gwz-berlin.de/180.html` [Access: 06/09/2016].

Laca, Brenda (2006). El objeto directo: La marcación preposicional. In Concepción Company Company (Ed.), *Sintaxis histórica de la lengua española. Primera parte: La frase verbal*, Volume 1, pp. 423–475. Mexico: Universidad Nacional Autónoma de México. Fondo de Cultura Económica.

Lang, Ewald and Claudia Maienborn (2011). Two-level semantics: Semantic form and conceptual structure. In Claudia Maienborn, Klaus von Heusinger, and Paul Portner (Eds.), *Semantics: An International Handbook of Natural Language Meaning*, Number 33.1 in Handbooks of Linguistics and Communication Science (HSK), pp. 709–740. Berlin: De Gruyter Mouton.

Langacker, Ronald (1969). *Foundations of Cognitive Grammar*, Volume 2. Stanford: Stanford University Press.

Larson, Richard K. (1988). On the double object construction. *Linguistic Inquiry 19*(3), 335–391.

Lenerz, Jürgen (1993). Zu Syntax und Semantik deutscher Personalpronomina. In Marga Reis (Ed.), *Wortstellung und Informationsstruktur*, pp. 117–153. Tübingen: Max Niemeyer.

Leonetti, Manuel (2007). Sobre la relación entre doblado de clíticos y movimiento de objetos. In Irene Gil, Héctor Fernández, and Raquel González (Eds.), *Cuadernos de Lingüística*, Volume 14, pp. 135–152. Instituto Universitario Ortega y Gasset.

Levine, Robert D. and W. Detmar Meurers (2006). Head-Driven Phrase Structure Grammar: Linguistic approach, formal foundations, and computational realization. In Keith Brown (Ed.), *Encyclopedia of Language and Linguistics* (2^{nd} ed.), Volume 5, pp. 237–252. Amsterdam: Elsevier.

Löbner, Sebastian (1986). In Sachen Nullartikel. *Linguistische Berichte 101*, 64–65.

Longobardi, Giuseppe (1994). Reference and proper names: A theory of N-movement in syntax and logical form. *Linguistic Inquiry 25*(4), 609–665.

Lyons, Christopher (1999). *Definiteness*. Cambridge textbooks in linguistics. Cambridge: Cambridge University Press.

Lyons, John (1977a). *Semantics*, Volume 1. Cambridge: Cambridge University Press.

Lyons, John (1977b). *Semantics*, Volume 2. Cambridge: Cambridge University Press.

Machicao y Priemer, Antonio (2010). *Die differentielle Objektmarkierung im Spanischen*. Online published Magister thesis, Humboldt-Universität zu Berlin. http://edoc.hu-berlin.de/docviews/abstract.php?id=40241 [Access: 26/08/2013].

Machicao y Priemer, Antonio (2014). Differentielle Objektmarkierung: Spezifizität und Akkusativ im Spanischen. In Antonio Machicao y Priemer, Andreas Nolda, and Athina Sioupi (Eds.), *Zwischen Kern und Peripherie: Untersuchungen zu Randbereichen in Sprache und Grammatik*, pp. 103–130. Berlin: De Gruyter.

Machicao y Priemer, Antonio (2016). HPSG. In Helmut Glück and Michael Rödel (Eds.), *Metzler Lexikon Sprache* (5^{th} ed.)., pp. 275. Stuttgart: Metzler.

Machicao y Priemer, Antonio (2018a). Argumentstruktur. In Stefan Schierholz and Pál Uzonyi (Eds.), *Grammatik: Syntax*, Number 1.2 in Wörterbücher zur Sprach- und Kommunikationswissenschaft (Online). Berlin: De Gruyter. (To appear; MyP).

Machicao y Priemer, Antonio (2018b). Kopf. In Stefan Schierholz and Pál Uzonyi (Eds.), *Grammatik: Syntax*, Number 1.2 in Wörterbücher zur Sprach- und Kommunikationswissenschaft (Online). Berlin: De Gruyter.

Machicao y Priemer, Antonio (2018c). Phrase. In Stefan Schierholz and Pál Uzonyi (Eds.), *Grammatik: Syntax*, Number 1.2 in Wörterbücher zur Sprach- und Kommunikationswissenschaft (Online). Berlin: De Gruyter. (To appear; MyP).

Machicao y Priemer, Antonio, Andreas Nolda, and Athina Sioupi (Eds.) (2014). *Zwischen Kern und Peripherie: Untersuchungen zu Randbereichen in Sprache und Grammatik*. Berlin: De Gruyter.

Machicao y Priemer, Antonio and Elodie Winckel (2015). Adjectives within Spanish and French NPs: Position and interpretation. Presentation at the 22nd International Conference on Head-Driven Phrase Structure Grammar (HPSG 2015) at the Nanyang Technological University, Singapore (10–14/08/2015) `http://compling.hss.ntu.edu.sg/events/2015-hpsg/pdf/MachicaoyPrimer_Winckel.pdf` [Access: 17/08/2015].

Maienborn, Claudia (2003). Event-internal modifiers: Semantic underspecification and conceptual interpretation. In Ewald Lang, Claudia Maienborn, and Cathrine Fabricius-Hansen (Eds.), *Modifying Adjuncts*, pp. 475–509. Berlin: Mouton de Gruyter.

Maienborn, Claudia (2011). Event semantics. In Claudia Maienborn, Klaus von Heusinger, and Paul Portner (Eds.), *Semantics: An International Handbook of Natural Language Meaning*, Number 33.1 in Handbooks of Linguistics and Communication Science (HSK), pp. 802–829. Berlin: De Gruyter Mouton.

Maienborn, Claudia (2016). Events and states. Manuscript. Eberhard Karls Universität Tübingen. To appear in Robert Truswell (ed.). Handbook of Event Structure. Oxford: Oxford University Press.

Manning, Christopher D. and Ivan A. Sag (1998). Argument structure, valence, and binding. *Nordic Journal of Linguistics 21*, 107–144.

Meurers, W. Detmar (1999). Raising spirits (and assigning them case). *Groninger Arbeiten zur Germanistischen Linguistik (GAGL) 43*, 173–226. `http://irs.ub.rug.nl/dbi/475d44439a8e3f` [Access: 18/07/2010].

Meurers, W. Detmar (2001). On expressing lexical generalizations in HPSG. *Nordic Journal of Linguistics 24* (2), 161–217. Special issue on 'The Lexicon in Linguistic Theory'. `http://purl.org/dm/papers/lexical-generalizations.html`.

Mittwoch, Anita (1982). On the difference between 'eating' and 'eating something': Activities versus accomplishments. *Linguistic Inquiry 13*(1), 113–122.

Motsch, Wolfgang (1999). *Deutsche Wortbildung in Grundzügen*. Berlin: Walter de Gruyter.

Muysken, Pieter (1982). Parametrizing the notion 'head'. *Journal of Linguistic Research 2*, 57–75.

Müller, Stefan (1999). *Deutsche Syntax deklarativ: Head-Driven Phrase Structure Grammar für das Deutsche*. Tübingen: Max Niemeyer. http://hpsg.fu-berlin.de/~stefan/Pub/ [Access: 03/04/2016].

Müller, Stefan (2009). On predication. In Stefan Müller (Ed.), *The 16th International Conference on Head-Driven Phrase Structure Grammar (HPSG 2009)*, Göttingen, pp. 213–233. CSLI Publications. http://web.stanford.edu/group/cslipublications/cslipublications/HPSG/2009/ [Access: 30/08/2013].

Müller, Stefan (2013a). *Head-Driven Phrase Structure Grammar: Eine Einführung* (3rd ed.). Tübingen: Stauffenburg.

Müller, Stefan (2013b). Unifying everything: Some remarks on Simpler Syntax, Construction Grammar, Minimalism, and HPSG. *Language 89*(4), 920–950.

Müller, Stefan (2014a). Artenvielfalt und Head-Driven Phrase Structure Grammar. In Jörg Hagemann and Sven Staffeldt (Eds.), *Syntaktische Analyseperspektiven*. Tübingen: Stauffenburg.

Müller, Stefan (2014b). Kernigkeit: Anmerkungen zur Kern-Peripherie-Unterscheidung. In Antonio Machicao y Priemer, Andreas Nolda, and Athina Sioupi (Eds.), *Zwischen Kern und Peripherie: Untersuchungen zu Randbereichen in Sprache und Grammatik*, pp. 25–39. Berlin: De Gruyter.

Müller, Stefan (2015a). The CoreGram Project: Theoretical linguistics, theory development and verification. *Journal of Language Modelling 3*(1), 1–66. https://hpsg.fu-berlin.de/~stefan/Pub/coregram.html [Access: 31/03/2015].

Müller, Stefan (2015b). HPSG – A synopsis. In Tibor Kiss and Artemis Alexiadou (Eds.), *Syntax – Theory and Analysis: An International Handbook*, Number 42.2 in Handbooks of Linguistics and Communication Science (HSK), pp. 937–973. Berlin: De Gruyter Mouton.

Müller, Stefan (2016a). *Grammatical Theory: From Transformational Grammar to Constraint-Based Approaches*. Berlin: Language Science Press. http://langsci-press.org/catalog/book/25 [Access: 18/03/2016].

Müller, Stefan (2016b). Phrasal constructions, derivational morphology, constituent structure and (cross-linguistic) generalizations: A discussion of template-based phrasal LFG approaches. `https://hpsg.fu-berlin.de/~stefan/Pub/lexical-integrity.html` [Access: 09/09/2016].

Müller, Stefan and Antonio Machicao y Priemer (2019). Head-Driven Phrase Structure Grammar. In András Kertész, Edith Moravcsik, and Csilla Rákosi (Eds.), *Current Approaches to Syntax – A Comparative Handbook*, Number 3 in Comparative Handbooks of Linguistics, pp. 317–359. Berlin: De Gruyter Mouton.

Müller, Stefan, Antonio Machicao y Priemer, and Elodie Winckel (2015). The architecture of CoreGram: Exemplified by the grammar fragments SpaGram & FrenchGram. Presented at the *Final Conference of the SFB 632 Information Structure: Advances in Information Structure Research 2003 – 2015*.

Müller, Stefan, Antonio Machicao y Priemer, and Elodie Winckel (2016). Die Architektur von CoreGram: Grammatikimplementierung mit Demo. Presented at the *DGfS 38. Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft: Sprachkonzil – Theorie & Experiment*.

Müller, Stefan and Bjarne Ørsnes (2013). *Danish in Head-Driven Phrase Structure Grammar* (in preparation). Berlin: Language Science Press. `http://hpsg.fu-berlin.de/~stefan/Pub/` [Access: 03/12/2014].

Netter, Klaus (1994). Towards a theory of functional heads: German nominal phrases. In John A. Nerbonne, Klaus Netter, and Carl Pollard (Eds.), *German in Head-Driven Phrase Structure Grammar*, pp. 297–340. Stanford: Center for the Study of Language and Information.

Nolda, Andreas, Antonio Machicao y Priemer, and Athina Sioupi (2014). Die Kern/Peripherie-Unterscheidung: Probleme und Positionen. In Antonio Machicao y Priemer, Andreas Nolda, and Athina Sioupi (Eds.), *Zwischen Kern und Peripherie: Untersuchungen zu Randbereichen in Sprache und Grammatik*, pp. 9–23. Berlin: De Gruyter.

Olsen, Susan (1991). Die deutsche Nominalphrase als 'Determinansphrase'. In Susan Olsen and Gisbert Fanselow (Eds.), *DET, COMP und INFL: Zur Syntax funktionaler Kategorien und grammatischer Funktionen*, pp. 35–56. Tübingen: Niemeyer.

Parsons, Terence (1990). *Events in the Semantics of English: A Study in Subatomic Semantics*. Cambridge: MIT Press.

Partee, Barbara H. (1997). Genitives – A case study. In Johan van Bethem and Alice ter Meulen (Eds.), *Handbook of Logic and Linguistics*, pp. 464–470. Amsterdam: Elsevier. Appendix to Theo M.V. Janssen, 'Compositionality'.

Payne, John and Rodney D. Huddleston (2002). Nouns and noun phrases. In Rodney D. Huddleston and Geoffrey K. Pullum (Eds.), *The Cambridge Grammar of the English Language*, pp. 323–523. Cambridge: Cambridge University Press.

Pollard, Carl Jesse (1994). Toward a unified account of passive in German. In John A. Nerbonne, Klaus Netter, and Carl Pollard (Eds.), *German in Head-Driven Phrase Structure Grammar*, pp. 273–296. Stanford: Center for the Study of Language and Information.

Pollard, Carl J. (2000). Lexical rules in HPSG: What are they? Manuscript.

Pollard, Carl J. and Ivan A. Sag (1987). *Information-Based Syntax and Semantics. Volume 1: Fundamentals.* Stanford: CSLI Publications.

Pollard, Carl J. and Ivan A. Sag (1994). *Head-Driven Phrase Structure Grammar.* Chicago: University of Chicago Press.

Postal, Paul M. (1969). On so-called 'pronouns' in English. In David A. Reibel and Sanford A. Schane (Eds.), *Modern Studies in English: Readings in Transformational Grammar*, pp. 201–224. Engelwood Cliffs: Prentice-Hall.

Primus, Beatrice (2009). Case, grammatical relations, and semantic roles. In Andrej Malchukov and Andrew Spencer (Eds.), *The Oxford Handbook of Case*, pp. 261–275. Oxford: Oxford University Press.

Przepiórkowski, Adam (1999). *Case Assignment and the Complement/Adjunct Dichotomy: A Non-Configurational Constraint-Based Approach.* Dissertation, Eberhard-Karls-Universität Tübingen. `https://publikationen.uni-tuebingen.de/xmlui/handle/10900/46147` [Access: 20/10/2015].

Pullum, Geoffrey K. and Barbara C. Scholz (2001). On the distinction between generative-enumerative and model-theoretic syntactic frameworks. In Philippe de Groote, Glyn Morrill, and Christian Retoré (Eds.), *Logical Aspects of Computational Linguistics: 4th International Conference, LACL 2001 Le Croisic, France, June 27–29, 2001 Proceedings*, Lecture Notes in Computer Science 2099, Le Croisic, France, pp. 17–43. Springer.

Rausch, Philip (2015). *Predicate-induced Semantic Prominence in Online Argument Linking: Experiments on Affectedness and Analytical Tools.* Dissertation, Humboldt-Universität zu Berlin.

Real Academia Española (2008a). Banco de datos (CREA) [en línea]: Corpus de referencia del español actual. `http://www.rae.es` [CREA].

Real Academia Española (2008b). Banco de datos (CREA. versión anotada) [en línea]: Corpus de referencia del español actual. `http://www.rae.es` [CREA].

Real Academia Española (2015). Banco de datos (CORPES XXI) [en línea]: Corpus del español del siglo XXI. `http://www.rae.es` [CORPES].

Real Academia Española and Asociación de Academias de la Lengua Española (Eds.) (2010a). *Nueva gramática de la lengua española: Morfología y sintaxis I* (2nd ed.), Volume 1. Madrid: Espasa Libros. [RAE 2010a].

Real Academia Española and Asociación de Academias de la Lengua Española (Eds.) (2010b). *Nueva gramática de la lengua española: Sintaxis II*, Volume 2. Madrid: Espasa Libros. [RAE 2010b].

Reis, Marga (1976). Reflexivierung in deutschen A.c.I.-Konstruktionen: Ein transformationsgrammatisches Dilemma. *Papiere zur Linguistik 9*, 5–82.

Reis, Marga (1988). Word structure and argument inheritance: How much is semantics? Comments on the paper by G. Fanselow. In Wolfgang Motsch (Ed.), *The Contribution of Word-Structure Theories to the Study of Word-Formation*, Number 179 in Linguistische Studien: Reihe A. Arbeitsberichte, pp. 53–67. Berlin: Akademie der Wissenschaften der DDR, Zentralinstitut für Sprachwissenschaft.

Richter, Frank (2000). *A Mathematical Formalism for Linguistic Theories with an Application in Head-Driven Phrase Structure Grammar.* Dissertation, Eberhard-Karls-Universität Tübingen. `https://publikationen.uni-tuebingen.de/xmlui/handle/10900/46230` [Access: 19/06/2016].

Richter, Frank and Manfred Sailer (2004). Basic concepts of Lexical Resource Semantics. In Arnold Beckmann and Nobert Preining (Eds.), *ESSLLI 2003 – Course Material I*, Number 5 in Collegium Logicum, pp. 87–143. Wien: Kurt Gödel Society.

Richter, Frank and Manfred Sailer (2009). Phraseological clauses in constructional HPSG. In Stefan Müller (Ed.), *The 16th International Conference on Head-Driven Phrase Structure Grammar*, Göttingen, pp. 297–317. CSLI Publications. `http://csli-publications.stanford.edu/HPSG/2009/hpsg09.pdf` [Access: 30/08/2013].

Russell, Betrand (1905). On denoting. *Mind 14*(56), 479–493.

Sag, Ivan A. (1997). English relative clause constructions. *Journal of Linguistics 33*(2), 431–483.

Sag, Ivan A. and Danièle Godard (1994). Extraction of 'de'-phrases from the French NP. In Mercè Gonzàlez (Ed.), *24th Annual Meeting of the North East Linguistic Society (NELS 24)*, University of Massachusetts, Amherst, pp. 519–541. GLSA. `http://lingo.stanford.edu/sag/papers/is-dg-nelspaper.pdf` [Access: 25/09/2016].

Sag, Ivan A., Ronald Kaplan, Lauri Karttunen, Martin Kay, Carl J. Pollard, Stuart Shieber, and Annie Zaenen (1986). Unification and grammatical theory. In Mary Dalrymple, Jeffrey Goldberg, Kristin Hanson, Michael Inman, Christopher Piñon, and Stephen Wechsler (Eds.), *5th West Coast Conference on Formal Linguistics (WCCFL)*, University of Washington, pp. 238–254. CSLI Publications.

Sag, Ivan A. and Thomas Wasow (2011). Performance-compatible competence grammar. In Robert D. Borsley and Kersti Börjars (Eds.), *Non-Transformational Syntax: Formal and Explicit Models of Grammar*, pp. 359–377. Oxford: Wiley-Blackwell.

Saussure, Ferdinand de (1916). *Grundfragen der allgemeinen Sprachwissenschaft* (2nd ed.). Berlin: Walter de Gruyter. (Edited by Charles Bally and Albert Sechehaye. Edition from 1967, with an epilogue of Peter von Polenz).

Schalowski, Sören (2009). *Über Topik-Drop im Deutschen: Untersuchung zum Einfluss der grammatischen Funktion und des Merkmals 'Person'.* Magister thesis, Humboldt-Universität zu Berlin.

Schäfer, Roland (2015). Processing and querying large web corpora with the COW14 architecture. In *Proceedings of Challenges in the Management of Large Corpora (CMLC-3)*, Lancaster. IDS Mannheim. `http://corpora.ids-mannheim.de/cmlc.html`. [DECOW]: `http://corporafromtheweb.org/decow14/`.

Schäfer, Roland (2016). *Einführung in die grammatische Beschreibung des Deutschen* (2nd ed.). Berlin: Language Science Press. `http://langsci-press.org//catalog/book/101` [Access: 05/10/2016].

Schäfer, Roland and Felix Bildhauer (2012). Building large corpora from the web using a new efficient tool chain. In Nicoletta Calzolari, Khalid Choukri, Thierry Declerck, Mehmet Uğur Doğan, Bente Maegaard, Joseph Mariani, Asuncion Moreno, Jan Odijk, and Stelios Piperidis (Eds.), *Proceedings of the Eight International Conference on Language Resources and Evaluation (LREC'12)*, Istanbul, Turkey, pp. 486–493. European Language Resources Association (ELRA). [ESCOW]: `http://corporafromtheweb.org/escow14/`.

Shieber, Stuart M. (1986). *An Introduction to Unification-Based Approaches to Grammar*. Stanford: Center for the Study of Language and Information.

Sioupi, Athina (2014). Result states, target states, and aspectual perfectivity. In Antonio Machicao y Priemer, Andreas Nolda, and Athina Sioupi (Eds.), *Zwischen Kern und Peripherie: Untersuchungen zu Randbereichen in Sprache und Grammatik*, pp. 157–180. Berlin: De Gruyter.

Solstad, Torgrim (2010). Post-nominal genitives and prepositional phrases in German: A uniform analysis. In Artemis Alexiadou and Monika Rathert (Eds.), *The Syntax of Nominalizations across Languages and Frameworks*, pp. 219–251. Berlin: De Gruyter Mouton.

Song, Sanghoun and Emily M. Bender (2012). Individual constraints for information structure. In Stefan Müller (Ed.), *The 19th International Conference on Head-Driven Phrase Structure Grammar (HPSG 2012)*, Chungnam National University Daejeon, pp. 329–347. CSLI Publications. `http://cslipublications.stanford.edu/HPSG/2012/song-bender.pdf` [Access: 20/10/2014].

Speas, Margaret J. (1990). *Phrase Structure in Natural Language*. Dordrecht: Kluwer Academic Publishers.

Stechow, Arnim von and Wolfgang Sternefeld (1988). *Bausteine syntaktischen Wissens: Ein Lehrbuch der generativen Grammatik*. Opladen: Westdeutscher Verlag.

Sternefeld, Wolfgang (2006a). *Syntax: Eine morphologisch motivierte generative Beschreibung des Deutschen*, Volume 1. Tübingen: Stauffenburg.

Sternefeld, Wolfgang (2006b). *Syntax: Eine morphologisch motivierte generative Beschreibung des Deutschen*, Volume 2. Tübingen: Stauffenburg.

Sternefeld, Wolfgang and Frank Richter (2012). Wo stehen wir in der Grammatiktheorie? Bemerkungen anlässlich eines Buchs von Stefan Müller. *Zeitschrift für Sprachwissenschaft 31*(2), 263–291.

Taylor, John R. (1994). 'Subjective' and 'objective' readings of possessor nominals. *Cognitive Linguistics 5*(3), 201–242.

Truckenbrodt, Hubert (2006). On the semantic motivation of syntactic verb movement to C in German. *Theoretical Linguistics 32*(3), 257–306.

Van Eynde, Frank (1994). *Auxiliaries and verbal affixes: A monostratal cross-linguistic analysis*. Habilitation thesis, Katholieke Universiteit Leuven.

Van Eynde, Frank (1999). Major and minor pronouns in Dutch. In Gosse Bouma, Erhard Hinrichs, Geert-Jan M. Kruijff, and Richard Oehrle (Eds.), *Constraints and Resources in Natural Language Syntax and Semantics*, pp. 137–152. Stanford: CSLI Publications.

Van Eynde, Frank (2006). NP-internal agreement and the structure of the noun phrase. *Journal of Linguistics 42*(1), 139–186.

Vater, Heinz (1984). Determinantien und Quantoren im Deutschen. *Zeitschrift für Sprachwissenschaft 3*(1), 19–42.

Vater, Heinz (1986). Zur NP-Struktur im Deutschen. In Heinz Vater (Ed.), *Zur Syntax der Determinantien*, pp. 123–145. Tübingen: Gunter Narr.

Vater, Heinz (1991). Determinantien in der DP. In Susan Olsen and Gisbert Fanselow (Eds.), *'DET, COMP und INFL': Zur Syntax funktionaler Kategorien und grammatischer Funktionen*, pp. 15–34. Tübingen: Niemeyer.

Vendler, Zeno (1957). Verbs and times. *The Philosophical Review 66*(2), 143–160.

Wechsler, Stephen M. (1991). *Argument Structure and Linking*. Dissertation, Stanford University.

Wechsler, Stephen M. (2015). *Word Meaning and Syntax: Approaches to the Interface*. Oxford: Oxford University Press.

Wunderlich, Dieter (1984). Zur Syntax der Präpositionalphrasen im Deutschen. *Zeitschrift für Sprachwissenschaft 3*(1), 65–99.

Zimmermann, Ilse (1990). Zur Legitimierung leerer Köpfe. In Anita Steube (Ed.), *Syntaktische Repräsentationen mit leeren Kategorien oder Proformen und ihre semantischen Interpretationen*, Number 206 in Linguistische Studien: Reihe A. Arbeitsberichte, pp. 75–90. Berlin: Akademie der Wissenschaften der DDR, Zentralinstitut für Sprachwissenschaft.

Zimmermann, Thomas E. and Wolfgang Sternefeld (2013). *Introduction to Semantics: An Essential Guide to the Composition of Meaning*. Berlin: De Gruyter Mouton.

Zubizarreta, Maria L. (1985). The relation between morphophonology and morphosyntax: The case of Romance causatives. *Linguistic Inquiry 16*(2), 247–289.

Zwicky, Arnold M. (1985). Heads. *Journal of Linguistics 21*(1), 1–29.

Index